AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 14, No. 15. WEEKLY. | NEW YORK, THURSDAY, APRIL 9, 1891. | $3.00 per Annum. SINGLE COPIES 6 CENTS.

COPYRIGHT 1891, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers. ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Eighteen and Twenty-one-inch Screw Machines.

On this page we give an illustration of a new screw machine recently brought out by the Lodge & Davis Machine Tool Co., Cincinnati, Ohio, the cut representing two sizes of the machine—18 and 21-inch—which are alike in design.

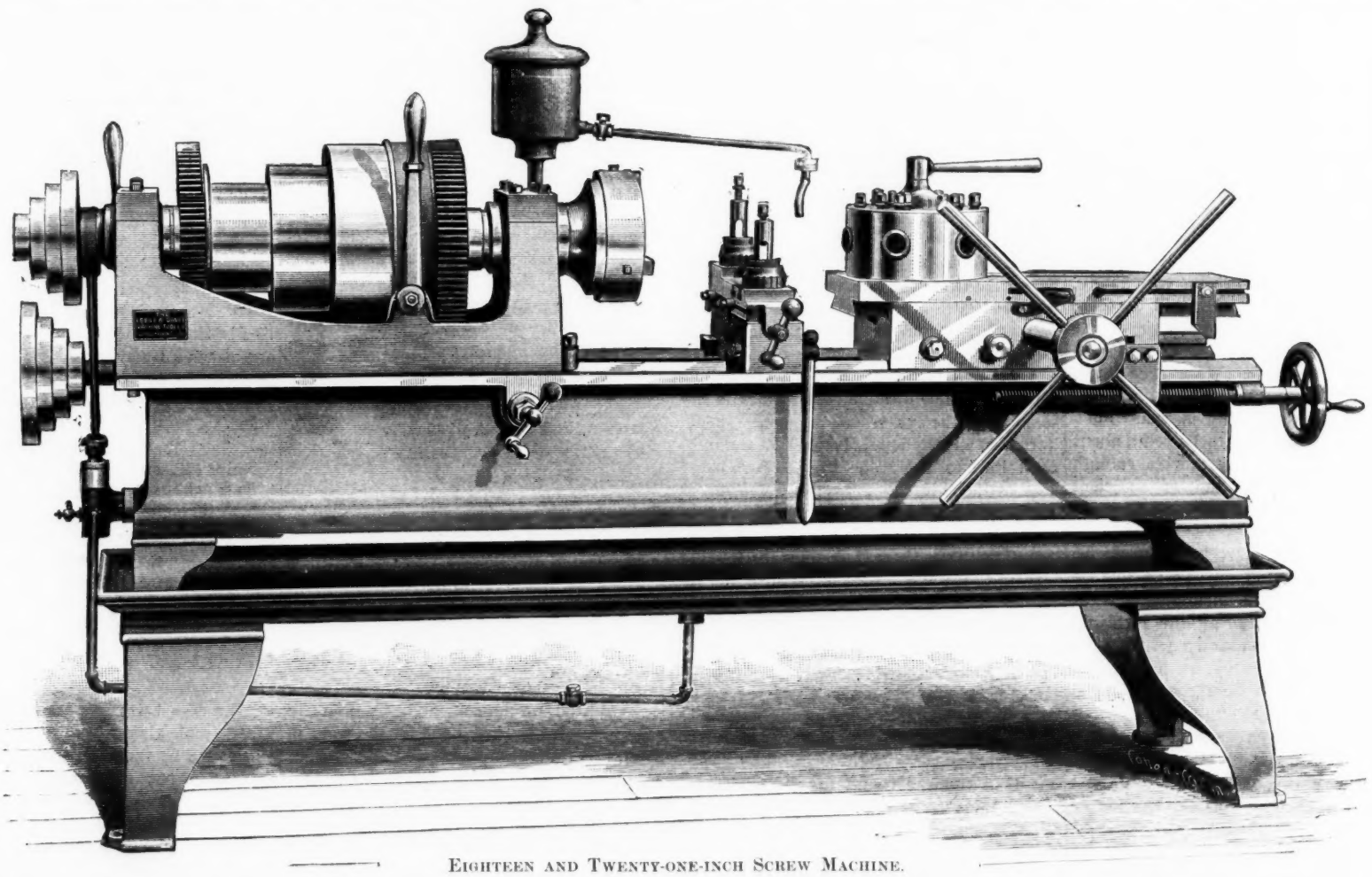
Among the most notable features of the machine are the depth of bed and length of head-stock, both, of course, tending to give the machine rigidity, and fit it for the heaviest work, which in fact the machine is especially designed for.

The long head-stock enables the spindle bearings to be placed far apart, and these bearings, which are of phosphor bronze, are of unusual size and length. The spindle is of steel, and hollow.

A wide belt is provided for, and the back gears, which can be thrown in or out without stopping the machine, are proportioned 4½ to 1. A friction device is used for changing from direct driving to back gears, which is worked by the lever at the side of the head-stock.

The double cut-off rest can be operated either by a lever or screw, as the character of the work may demand, and is adjusted on the bed to or from the chuck by means of a screw, which is operated by means of bevel gears, and the crank handle seen at the side of the bed, below the main spindle bearing. Suitable stops are provided for duplicating the diameter, and the tools rest on adjustable collars of hardened steel by which their height may be regulated by a screw motion. There is a power feed for the turret slide, which has four rates from 70 to 180 per inch, the feed being automatically released at any desired point. The turret revolves automatically, and a new trip mechanism allows the locking key to be withdrawn at any point of the slide movement so that the turret may be revolved by hand. The turret block is moved on the bed by a screw with hand-wheel, affording a convenient means of moving and adjusting the block, and an additional security against movement by end thrust. The turret has six 1¼-inch holes, each with two set-screws for holding the tools.

A plunger pump at the end of the machine supplies abundance of oil, and this may be kept upon the tools by means of a swivel joint in the pipe leading from the tank. A three-jawed universal chuck is fitted to the spindle. The 18-inch machine has a bed 6 feet 7 inches long, and weighs 3,100 pounds; the 21-inch, a bed 7 feet 2 inches long, and weighs 4,100 pounds.



EIGHTEEN AND TWENTY-ONE-INCH SCREW MACHINE.

Train wrecking is, as it were, becoming fashionable again, accounts of wrecking trains, or attempts to that end, being matters of almost daily news. The operations of train wreckers are the most cowardly of any imaginable, and no mercy should be shown men who engage in such enterprises. The penalty for unsuccessful attempts ought to be made greater than it is.

The employes of the Reading Iron Company have submitted to a slight reduction in wages, upon the promise that the scale shall be restored as soon as business improves sufficiently to warrant it.

On Keeping Shafting in Line.

BY PETER H. BULLOCK.

It has been demonstrated that shafting that is out of level or line, that is crooked, either in itself or by reason of improperly fitted couplings, or that is insufficiently supported, or distorted by too tight belts, may consume from 10 to 40 per cent. more power than is necessary when everything is in proper shape. In view of the fact that there are literally thousand of plants where all of the apparatus for the transmission of power is in the care of the engineer, and that very many of these men may never have had opportunity or occasion to study up the subject, I have decided to devote this paper to various simple things in connection with shafting, and the best ways of caring for the same.

In the first place, I will say that I am not sure that all the ways of doing things that I may describe are the right or only ways; they are more the ways of a layman than of a professional millwright. They are, however, no untried schemes, but various kinks that have been used in overcoming difficulties at divers times, and often under adverse circumstances. Many times an end may be reached where the means employed are immaterial, or even unprofessional.

In the first place I want to eulogize the good old millwright, not that the race is extinct, for there are still good ones among us, but the distinctive features of the trade seem to be merging into others. The millwright is a carpenter, inasmuch as he does first-class joiner and woodwork; he comes pretty near being a machinist, inasmuch as he erects machinery, and takes it apart and puts it together again without battering up the hubs and centers with the pene of his broad-axe; he gets the right line from the engine, and erects the shafting so that the belts all run correctly; he doesn't split coupling hubs by driving the wrong key in edgewise, nor spring a long length of shafting by hoisting it into position suspended by its center. He is too good a mechanic to do any of these things; he will do the work right, and no doubt about it. Let us suppose that the building in which he has done this creditable work is new and unoccupied, and the plant is left in charge of the engineer. Let us now imagine that six months have elapsed. An indicator diagram taken for friction at the start figured 22 horse-power, while now a similar card figures 36 horse-power, and there has been only 60 feet of shafting and 300 feet of permanent belting added since the first was taken. At first, the bearings, belts, etc., were all new and stiff, now they should be down to business and run easier; but instead, we find a 5 per cent. increase in the visible load, and 63 per cent. increase in the invisible load. Where is it?

Our friend the millwright erected things as they should be, but various additions and changes have been made that would not have met that mechanic's approval had he been consulted. In one case, a machine that required two pulleys on the shaft six feet apart was located without reference to whereabouts on the shaft the pulleys would come, and, as a consequence, one came in the center of a ten-foot span, and the other just

where the hanger was. They could not easily slip the hanger towards the first pulley, on account of a coupling being there, so they moved it the other way; and while they were about it, they gave room for a six-inch belt to be thrown off between the pulley and hanger, which made the span between the two hangers twelve feet and four inches, and with two tight belts pulling in the same direction. The work was done by inexperienced men, and there was no means taken to see that the shaft was in line or level after the hanger was moved. Power had been taken to a distant room, and in a very unmechanical manner. After six months of steam heat, and the floors loaded with goods and machinery, the shafting can hardly be expected to be in good, or even fair condition. On examination, it will be found that the floors have settled and shrunk, that the timbers have warped and sprung some of the hangers out of their proper position. Some of the hangers will have become loose, and shifted from where they were put. Other bearings that may have been located in walls, or near supporting columns, will be found to be just where they were put, while perhaps the ones nearest to them are the ones that will have moved the most.

Now let us see about getting things in line again. In the first place throw off all except the main belts, so as to let the shaft assume its natural position. When this is done, get the shaft level, and in this day of adjustable hangers it surely should not be a very hard job; but if it is found to be out more than can be adjusted by the hanger, do not let it go, but cut the timber or shim down, as the case may require. In some shops the pulleys and hangers are so thick that it is hard to find a clear space large enough to get the level onto the shaft. For use in such cases, a pair of implements like the one shown in Fig. 1 become very handy, if not actually necessary. It will be seen, that, no matter what the diameter of the shaft is, the inverted V part will always retain the same relative position. The lower part can be of any convenient length, and sometimes the bracket part is made movable, but I prefer them to be solid, about two feet long, and the V part wide enough to span a 5-inch shaft, and of sufficient width so that it will certainly hang firm and plumb.

After getting the shaft level, it will be necessary to get it into line. To do this we must have something we know to be right to start from, and then bring the rest into line with that. This is usually got from the engine or jack-shaft, or a section of the main shaft known to be right, as, for instance, the part where the power is received, which is usually heavier and more solidly erected. When this is so, it is only necessary to draw a line parallel to that part known to be right, and continue it as far as may be needed or practical, beside that which is to be tested. This line should be stretched very tight, exactly opposite the center of the shaft, and far enough away to clear the rims of pulleys. To get this line just right will require close and careful measuring. A forked stick, with a pin or nail driven into the other end, is often used for this purpose, and subsequent corrections of the shaft. If used correctly this is all right, but one is apt to hold it a little out of square, and it takes but very little to introduce very decided errors. I use an instrument such as shown in Fig. 2. It is simply a steel pointer sliding in a piece of one-eighth pipe, and held in any desired position by the thumb nut. The other end of the pipe is screwed into a double V arrangement, and in use will always stand at right angles to the shaft. There is no patent on this thing, and some of our implement and tool makers had better put them on the market.

As before said, there must be something to start from, and if this is but a single length of shaft, be very careful to get the line exactly parallel to that, and then stretch beside as much as may be convenient. If this distance is very long, put up one or more strips at right angles to and level with the center of the shaft for the line to rest on. These must be even and smooth on top, so they will merely support the line, and not hold it a particle out of truth. When this is done you have simply to go along and bring the shaft to the line by adjusting each bearing separately. In the case of a mill like the one supposed, you will find that the shaft has got a good ways from where the millwright left it. You must be sure of the correctness of your line, and then bring the shaft to it, even if you have to move the hangers an inch to do it. In bringing a shaft into line,

Fig. 1.

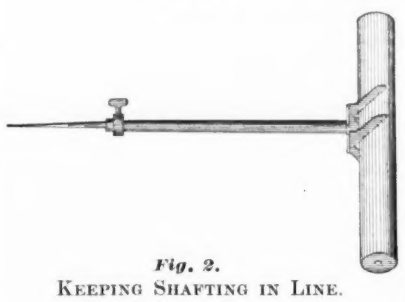


Fig. 2.
Keeping Shafting in Line.

you must be careful to allow one-half the difference in the diameter of the shaft where there is a change in the size.

A Boston oculist, Dr. John H. Payne, is reported by a correspondent of the St. Louis *Globe-Democrat* as saying: "Most persons who use the incandescent electric light like a new lamp because the light is whiter and more brilliant than after the lamp has been in use for two or three weeks. This is wrong. It is this dazzling white light that harms the eye. An old lamp is the best, for in these the light has become changed to a pale yellow, which is the ideal color. Just as in noonday brightness human sight is not so clear and far-reaching as at the yellow sunset, so a new incandescent burner is not so good for the eye as an old one. An old burner so adjusted and shaded that the light from it does not shine in the face, is the ideal artificial light. An argand gas-burner comes next. The use of the arc light should be confined to street lamps. Some storekeepers still use them, but they are terribly hurtful to the eye. This is because the intensity of the light is constantly changing, and this jumping of the blaze is much worse for the eye than the flicker of the gaslight. I have had occasion to treat a great many people for inflammation of the retina caused by working by the light of arc lamps."

Finding Change Gears for Odd Pitches.

By George B. Grant.

A competent lathe hand should be able to figure out the change gears required for cutting odd pitches and ugly numbers of threads to the inch; but how many can do it? This common and important feature of the engine lathe is generally bounded by the table of change gears found screwed to the head-stock, and, once off that plate, the average lathesman is lost.

I am not now talking to the man who is perpetually asking for the rule for figuring change gears in ordinary cases, who has a common six to the inch leading screw, and wants to know what gears to use to cut four to the inch, but I will leave him to struggle with the a b c of the matter, and address the man who is generally all right, and only gets "stuck" when an unusually ugly case makes its appearance.

To begin at the beginning, we will suppose that some customer, for some peculiar purpose, must have a screw that will throw its nut just 12.37″ in 47 turns, and the job must be done to a degree of accuracy considerably inside a hundredth of an inch.

The ordinary lathesman, and, perhaps, one that is not so ordinary, is now stuck tight, for the common process shows that the change gears required for a 7 to the inch leading screw must have 8,659 and 4,700 teeth, and such huge numbers are out of the question. Some pair of gears within common limits must be found that will serve instead, and give the required 12.37″ in 47 turns near enough for the purpose, and the puzzle is to do it. There are three ways to do it.

First way: Get a supply of paper and ink, and strike right and left until you get it. You may hit it in an hour, and perhaps not in a day. Any one can work this method, and it is the most common one in use. You know there must be some pair of numbers, both between 15, the smallest change gear you can get on the lathe, and 100, the largest that will go on, and if you are lucky, and have paper enough, you will hit the pair after awhile.

Second way: This is a little more scientific; a cross between guesswork and calculation, and not so very long. The proportion of the ugly numbers to be avoided—8,659 and 4,700—is 1.8423, and the desired gears must have very nearly the same proportion. The smallest gear admissible has 15 teeth, and 15x1.8423 is 27.635. Therefore 15 is not the number, for its mate must be 27 and a large fraction. Now proceed from 15 up the line by adding 1.8423 until you find a sum that is practically a whole number, as shown below:

$$1.8423 \times 15 = 27.635 + 1.842$$

$$1.8423 \times 16 = 29.477 + 1.842$$

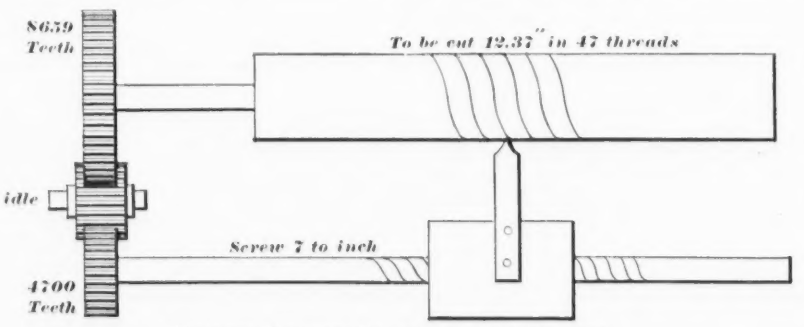
$$1.8423 \times 17 = 31.319 + 1.842$$

$$1.8423 \times 18 = 33.161 + 1.842$$

$$1.8423 \times 19 = 35.003$$

Going along thus, step by step, it is soon found that 19 and 35 will be very nearly in the required proportion, and, by figuring out the result of using them for the work in hand, it is found that there would be 12.369″ cut in 47 turns. As the error is but a thousandth of an inch, the two gears will answer the purpose perfectly.

This happy result is quickly reached in this particular case, but usually it is more elusive, and possibly the result will not appear until forty or fifty trials have been made. A good computer can cut it short by going over many steps at once, taking steps of ten teeth at once, but the average man would miss his mark in that way, and had better take it but one step at a time.



Finding Change Gears for Odd Pitches.

Third way: This method is by pure calculation, without an element of guesswork in it.

Divide the larger gear by the smaller, to get a whole quotient number and a remainder; then divide the first divisor by the remainder, to get another whole quotient and remainder, continuing the process as far as may be desirable, as detailed below:

```
4700) 8659 (1
      4700
      ----
3959) 4700 (1
      3959
      ----
 741) 3959 (5
      3705
      ----
 254) 741 (2
      508
      ---
 233) 254 (1
      233
      ---
  21) 233 (11
      21
      --
      23
      21
      --
   2) 21 (10
      20
      --
   1) 2 (2
      2
      -
      0
```

Now, by taking different numbers of these quotients 1, 1, 5, 2, 1, 11, 10, 2, we can get fractions that are each one an approximation to the given fraction, and the more there are used the closer will the approximation be. If we take two or three we get a rough agreement, a nearer one by taking several, and by taking them all we get the original fraction. To illustrate, take six quotients as follows: 11, 1, 2, 5, 1, and 1. Now place these in a vertical row as shown, and attach to them fractions as follows:

$$11$$
$$1\tfrac{1}{1}$$
$$2\tfrac{1}{1}$$
$$5\tfrac{1}{2}$$
$$1\tfrac{2}{5}$$
$$1\tfrac{5}{7}$$
$$1\tfrac{7}{12} = \tfrac{409}{222}$$

To the second one attach a fraction made by dividing 1 by the first one; to the third one attach a fraction made by reducing the second one to a common fraction and reversing it; to the fourth attach a fraction made by reducing the third one to a common fraction, and then reversing it, and so on until the fraction 409 ÷ 222 is reached.

This fraction is a close approximation, but it is as unhandy in use as the original one, and therefore we must be content with a rougher approximation obtained by using five quotients, as follows:

$$1$$
$$2\tfrac{1}{1}$$
$$5\tfrac{1}{2}$$
$$1\tfrac{2}{5}$$
$$1\tfrac{5}{7} = \tfrac{35}{19}$$

the process being the same as before detailed, and giving the same fraction that was found by the other process.

There is one difference between the second and third methods that is not at first apparent. When the result was reached by the second method there was no way to tell whether some other was not better for the purpose, but by the third method it is certain that there is no fraction between $\frac{409}{222}$ and $\frac{35}{19}$ that will serve the purpose better than the latter.

The second process must be carried from 19 up to 222 before striking a number that is nearer a whole number than 35.003.

To take another illustration, it was found necessary to cut a large worm hob with a pitch of five inches, and, as such a pitch would tear the ordinary screw gearing to pieces, the small gear on the cone was connected with the lead screw by a train of gears on an improvised arm. But here a difficulty arose, for the back gears of the lathe were of 86, 26, 88 and 24 teeth, and the odd combination required change gears of 2,925 and 946 teeth.

By the process above described it was found that change gears of 68 and 22 teeth would answer the purpose, and that with them the thread could be cut with an error not perceptible to the eye, but which was calculated to be less than $\frac{7}{1000}$ of an inch.

New Jersey railroads will pay in the way of taxes this year $1,010,503.

The Briggs Standard.

We have numerous inquiries for information regarding the sizes of taps and dies called for by the standard in use in this country, and for the convenience of our readers have added two columns to the table published as part of our report of the proceedings of the American Society of Mechanical Engineers, issue of March 19, 1887.

STANDARD DIMENSIONS OF WROUGHT-IRON WELDED TUBES.

DIAMETER OF TUBE.			THICKNESS OF METAL.	SCREWED ENDS.			
Nominal inside.	Actual inside.	Actual outside.		Number of threads per inch.	Length of perfect screw.	d = diameter of bottom of thread at end of pipe in inches.	d_2 = diameter of top of thread at end of pipe in inches.
Inches.	Inches.	Inches.	Inch.	No.	Inch.		
$\frac{1}{8}$	0.270	0.405	0.068	27	0.19	.334	.393
$\frac{1}{4}$	0.364	0.540	0.088	18	0.29	.433	.522
$\frac{3}{8}$	0.494	0.675	0.091	18	0.30	.567	.656
$\frac{1}{2}$	0.623	0.840	0.109	14	0.39	.701	.815
$\frac{3}{4}$	0.824	1.050	0.113	14	0.40	.911	1.025
1	1.048	1.315	0.134	$11\frac{1}{2}$	0.51	1.144	1.283
$1\frac{1}{4}$	1.380	1.660	0.140	$11\frac{1}{2}$	0.54	1.488	1.627
$1\frac{1}{2}$	1.610	1.900	0.145	$11\frac{1}{2}$	0.55	1.727	1.866
2	2.067	2.375	0.154	$11\frac{1}{2}$	0.58	2.2	2.339
$2\frac{1}{2}$	2.468	2.875	0.204	8	0.89	2.62	2.82
3	3.067	3.500	0.217	8	0.95	3.241	3.441
$3\frac{1}{2}$	3.548	4.000	0.226	8	1.00	3.738	3.938
4	4.026	4.500	0.237	8	1.05	4.235	4.435
$4\frac{1}{2}$	4.508	5.000	0.246	8	1.10	4.732	4.932
5	5.045	5.563	0.259	8	1.16	5.291	5.491
6	6.065	6.625	0.280	8	1.26	6.346	6.546
7	7.023	7.625	0.301	8	1.36	7.34	7.54
8	7.982	8.625	0.322	8	1.46	8.334	8.534
9	9.000	9.688	0.344	8	1.57	9.39	9.59
10	10.019	10.750	0.366	8	1.68	10.445	10.645

Taper of conical tube ends, 1 in 32 to axis of tube.

This report and table will also be found in Vol. VIII, Transactions of the Society. Most of our correspondents wish to know the size of the tap at the middle of its length, but this cannot be defined, because the size at that point will depend upon the distance it is desired to have the tap go into the fittings beyond the end of the pipe, this distance having no effect whatever upon the standard. The Briggs standard, which is the recognized standard for pipe threads in this country, fixes only the taper, number of threads per inch, angle of the thread, and diameter at the bottom of the thread at the extreme end of the pipe. The angle of the thread is 60°, and it is slightly rounded off at top and bottom, so that, instead of its depth being equal to its pitch, as is the case with a full V-thread, it is $\frac{4}{5}$ the pitch, or equal to $0.8\frac{1}{n}$, n being the number of threads per inch.

We republish herewith the table which was included in the report referred to, and to this table we have added the last two columns of figures, those in the seventh column being derived from the formula,

$$D - (0.05\,D + 1.9) \times \frac{1}{n},$$

in which D = outside diameter of the tubes, and n the number of threads to the inch. The figures in the eighth column were derived from the formula $0.8\frac{1}{n} \times 2 + d$, in which d is the diameter at the bottom of the thread at the end of the pipe.

This formula reduces to $1.6\frac{1}{n} + d$. Having the taper, length of full threaded portion, and the sizes at bottom and top of thread at the end of the pipe, as given in the table, taps and dies can be made to secure these points correctly, and the balance will take care of itself. The length of the imperfectly threaded portions on the pipe, and the length the tap is run into the fittings beyond the point at which the size is as given, or, in other words, beyond the end of the pipe, having no effect upon the standard.

Speaking of the results of excavations made at the Roman city of Silchester, the London *Times* says:

The principal specimen is a carpenter's plane of quite modern type, although unquestionably more than 1,500 years old, there are several large bars of iron, a couple of plowshares and a broken sword. Probably more will be found deeper down in the well. This is undoubtedly the most important find at Silchester since the discovery of the bronze Roman eagle, now at Strathfieldsaye, some years ago.

Conveniences in the Machine Shop.

BY A MECHANIC.

It would certainly be a great convenience if the face-plates of similar lathes would interchange, and could be depended upon to run about true every time. I kicked at the interchangeable lathe center, for I do not believe this is much needed. We often see small chucks, and sometimes quite large ones, fitted to the center holes. I contend that this is bad practice, for the center hole never was intended for such use. The taper hole in a drill spindle or milling machine is provided with a slot to fit a tenon on the shank of tools, but the lathe is not so arranged; more than this, the lathe spindle has a small hole, too small to drive much by friction alone, and so we often find such holes badly out of shape, caused by tools turning under heavy pressure. When chucks are fitted to the center hole we are prevented from using this hole for the work to extend into. When we have a hollow spindle, and a chuck fitted to the thread, we can run a long rod through the spindle so as to do work on the end. When we do not have a hollow spindle we could get along much better sometimes if we could let our rod extend to the bottom of center hole. I believe the reason why we now find so many tools or fixtures fitted to center holes is because this has been the only part that could be depended upon to be true. Makers, I think, have always made their centers interchange better than the face-plates, and this may have had something to do with it.

When we come to interchangeable face-plates—a kind that will interchange and will run true—I hold up both hands in their favor. I asked the question: What is the matter with what we have already got? Besides the fact that they don't interchange very well, they won't always run true. The principal reason for this is dirt. The face-plate thread is usually badly cut, that is, it is rough; we can't wipe it out, for if we try we will find it is like wiping a piece of card clothing against the grain. If we wipe out a little dirt, we at the same time wipe in a lot of waste, and one is as bad as the other. We can't see the sides of the thread very well, so we don't know whether it is full of dirt or not. The thread is sharp, and so affords a good chance for dirt to crowd in, and stay. There is this one objection to the interchangeable face-plate. Some maker might think a 4″ spindle about right, and his neighbor might think a 2″ spindle rather large for the same size of lathe The interchangeable face-plate would have to split the difference, and so we would see some spindles with a big head on them, and others with a small one, but, whether large or small, we want interchangeability.

Now if a rig that depends entirely upon absolute fineness of fit is decided upon, we shall not get it, no matter how much theory goes with it. Fig. 1 shows a scheme I borrowed from a friend for the occasion. I believe we could have interchangeable face-plates by this plan. He would have a square thread loosely fitted. Unless we have quite a long taper we would have to depend a little, I think, upon the side of the thread for truth of face of plate.

If hardened spindles were used the thread might be as is shown in Fig. 2—a ratchet tooth thread with clearance at the bottom, and its room is better than its company in this case. With a ratchet tooth thread we can do about the same work with one-half the length; this is an advantage. If any one wants to harden the end of spindle the thread could be made like Fig. 4. It would not be possible to grind as close to the shoulder as we can cut with a tool, but we could get over this by making the end longer. I would not use a tap in cutting the inside thread, but would cut it with a tool, smooth, and then polish it a little with emery on a pine stick, so it could be wiped out clean with a piece of waste. This thread is of such shape, and the nut is so short, that we can see every part of the surface of the thread, and so know when it is clean. The inside thread is shown in Fig. 5. As we can't cut any thread close to the shoulder, I would—instead of counterboring, as is usual—chip out the last part of the thread so it will come to a square end, as is shown at A; this lets the face-plate up without wasting so much of the thread as when we counterbore.

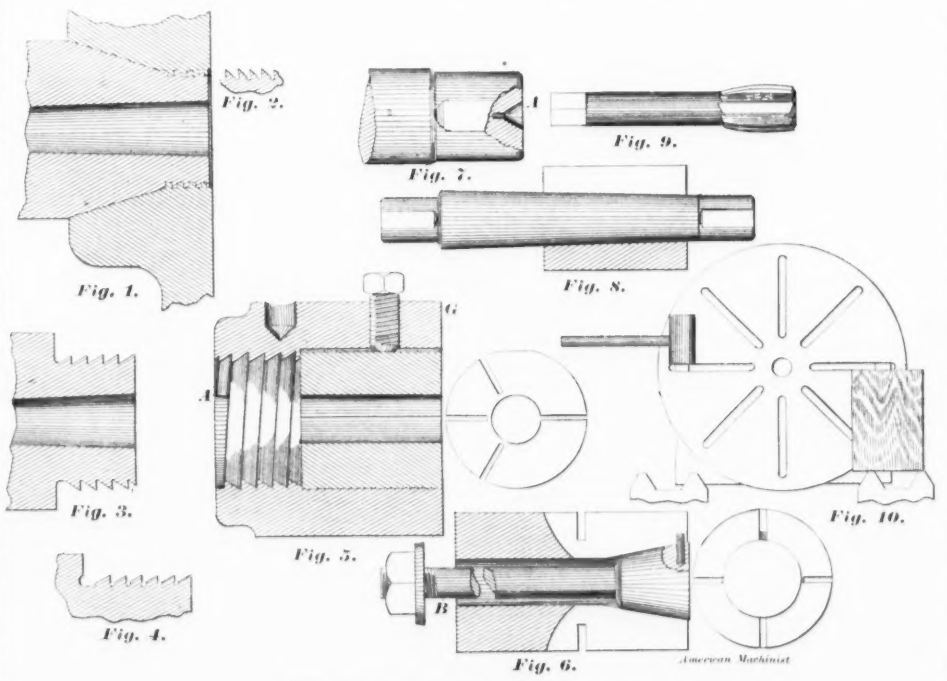
In Fig. 5 is shown a chuck that, with a screw thread which would insure truth, would prove a very convenient tool. In a shop where standard sizes are in use, we could have split bushings with their outsides turned to fit this chuck, and holes to correspond with the standard sizes most in use. These bushings would be all right if made of cast-iron. I would have bushings to correspond with each taper shank in use in the shop. For the bushings with straight holes we could have those with an inch hole and under fit the $1\frac{1}{2}$″ bushing, and those of $\frac{1}{2}$″ and under fit the $\frac{3}{4}$″ bushing, and so we would be able to get down to the smallest wire.

Fig. 6 shows a bushing for holding work by the hole so as to get at the other end. The idea is with a hollow spindle to have the bolt B extend through, so that the nut will screw up against the rear end of spindle, and thus expand the bushing in the hole; first, have the bushing out a little from back of chuck, then if the back side of work has been squared true we can slack up the set-screw, and, by screwing up on the nut at rear end of spindle, draw the work up tight against face of chuck G.

I hardly agree with Mr. Barnard when he says that a soft arbor is as good as a hardened one. I believe that hardened arbors are just the proper thing, and that in the long run they are much cheaper than any other kind I have seen. Of course, to make good hardened arbors without some kind of a grinder is out of the question, but with a grinder the cost of making need not be much more than for soft ones. Hardened arbors do not get cut. Of course, it is not necessary to cut arbors, but the soft ones get cut just the same, and the hard ones don't. No matter how careless a workman may be, he always stops feeding when his tool strikes a hardened arbor. Hardened arbors save time. A man has to take time and be careful, when squaring a piece on a soft arbor, not to damage the arbor.

Arbors, as a general thing, do not have centers large enough; I think the centers should be fully as large in proportion to the size of arbor as is shown in Fig. 7, and I believe the center should have the corners rounded at A. [The engraving does not show this, but it will be understood.]

Arbors get out of true after a while, and perhaps it would be well to look into this matter a little. It seems that the wear would be equally divided around the center, but it does not appear to work that way. One trouble, I think, is that the center is not well reamed; its bearing is better on one side than on the other, and so it wears faster on the side with the least bearing. To remedy this I would propose to be careful in reaming the center first, then, after hardening, use a copper center lap with fine emery and oil, and lap out the centers till down to hard pan



CONVENIENCES IN THE MACHINE SHOP.

all around. It would be well if this little center lap was used more in some shops to keep arbors true. The taper arbor and split bushing shown in Fig. 8 has its uses. This bushing should be split the same as the chuck bushings, except that the splits should be equally divided.

Fig. 9 shows a kind of lathe reamer for use just to size a hole ready for the hand reamer. Lathes, as a general thing, are not kept exactly in line, and so when we undertake to run a long, straight reamer through on the center it works bad. This lathe reamer should be cleared a little (I have shown this much magnified); this can be done by grinding. A chuck drill is not reliable enough, so I drill out a hole the same as usual, then put the lathe reamer through.

I want to say a few words about starting a tight face-place for the benefit of the boys, so for fear that some genuine machinists will feel insulted, I will ask them to shut their eyes at this part. I have seen plenty of boys who did not know of any good way to start a tight face-plate, and I think by what Mr. Woodward said about seeing some workmen pounding a face-plate on the hub to draw it so as to make it start, that there are men who don't know. One day a fellow was trying to get the face-plate off a big lathe by hammering; he was in lots of trouble, for it would not start; at last he asked me if I could not help him. I took hold of the plate with my hand, and turned it off. He had got it started and did not know it, for a hammer blow would not move this large face-plate much. He had been used to working on a small lathe, and thought that any face-plate would "spin" when you hit it. I never got stuck at taking off a tight face-plate yet, and I never pounded one on the hub, either. I have always found that if I kept the plate from turning by a block of wood set on the ways, and a tool in a slot in plate as is shown in Fig. 10—or any way that would keep it from turning—and then put the belt on the slowest speed, and, with back gearing in, pulled hard, it would usually start, but when it does not I keep a good strain on it, and then get some one to pound on the front side—it always starts then, for me.

Prof. V. B. Lewes, of England, in a lecture on the use of gas, said no gas stove, geyser, or gas cooking stove should be used without ample and thorough means of ventilation being provided, and no trace of the products of combustion should be allowed to escape into the air; until this is done, the use of improper forms of stove will continue to inflict serious injury on the health of the people using them, and this will gradually result in the abandonment of gas as a fuel, instead of, as should be the case, its coming into general use. Already signs are not wanting that the employers of gas stoves are beginning to fight shy of them. I hope that the gas managers of the kingdom will bring pressure to bear upon the stove manufacturers to give proper attention to this all-important question.

We recently noted the fact that there was a good deal of dissatisfaction in England over the long hours required of railway employes. This has led the London & Northwestern Railway Company to make some important concessions in the way of shorter hours.

The telephone between London and Paris is in actual operation.

Machinery for Manufacturing Wood Pulp.

Wood pulp has become in late years quite an important article of manufacture, and improved or new machines for its production are constantly in demand. The Lowville Iron Works Company, of Lowville, New York, among their other line of work, such as saw-mill machinery, pumps, etc., make a wood pulp grinder rests on a very solid bedplate. The boxes *E* are firmly fastened with four bolts, and can be adjusted on planed ways by means of set-screws with lock nuts as shown.

The cylinders *B* are lined with seamless brass tubing, and fitted with improved four-way valves of brass, with brass seats accurately ground. Pressure in these cylinders is obtained by means of two pumps, preferably a triplex, to force the wood against the stone; the piston is returned by a common centrifugal pump, such as is found in every mill. With this arrangement each cylinder is made independent of the others, and a pocket may be refilled without relaxing the pressure on the other cylinders, and racing of the stone is thereby avoided. The piston packing consists of two pieces of heavy sole leather shaped in a mold under pressure. It has been found that this packing is very suitable for the purpose; it requires less pressure to open it against the sides of the cylinder, and it is also said to be more economical than many other kinds of packing used in this class of machinery.

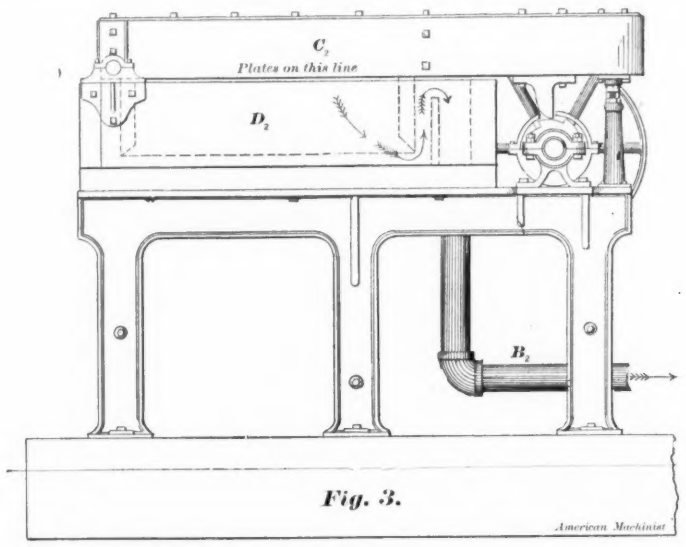


Fig. 3.

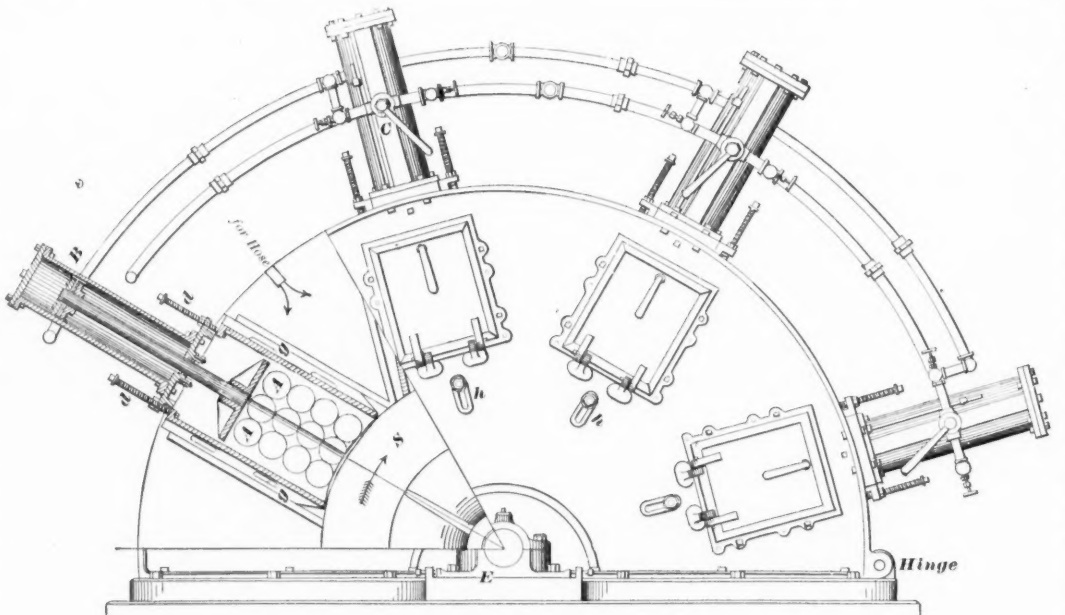


Fig. 1.

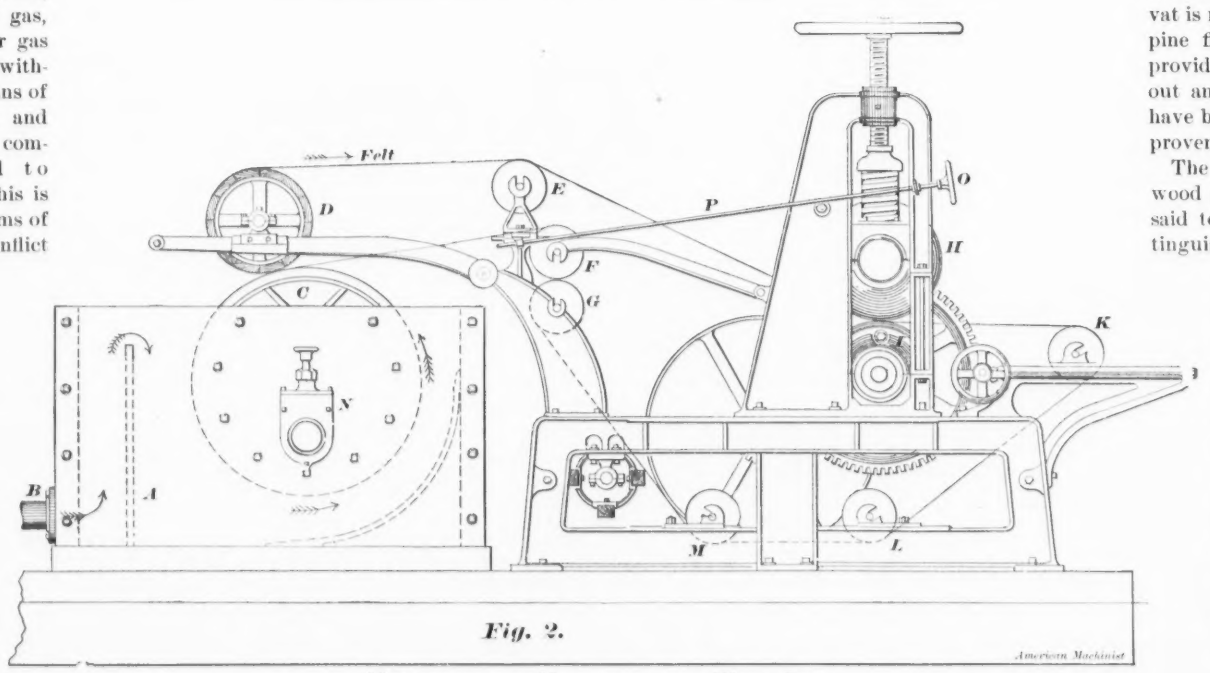


Fig. 2.

MACHINERY FOR MANUFACTURING WOOD PULP.

The slots *h h* are used to adjust the pieces on side of machine inside of pocket, as the stones wear down.

The hinge on end is used when putting a new stone into the machine by disconnecting pipes from pump, taking out holding-down bolts, and tipping the machine back.

The purpose of the wet machine, Fig. 2, is to extract the water from the pulp, and press the pulp into sheets ready for shipment. The special claim for this machine is the extra high test it gives; that is, the pulp leaves the press in a comparatively dry state, or with as small a percentage of water as is practicable. To meet these requirements, the housing of the press rolls are made very strong, and a constant pressure, which must be applied to the pulp as the felt carries it between the rolls, is obtained by screw and hand-wheel, a six-ton spring being fitted between collar and screw on roll box. The felt rolls are all inside of the felt, and run in adjustable babbitted boxes. The stretch roll which maintains the tension on the felt is operated from the front by means of a screw and hand-wheel. The cylinder vat is made of selected three-inch pine firmly bolted together, and provided with the necessary wash-out and suction valves. Patents have been applied for on the improvements.

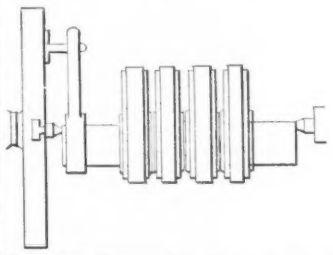
The process of manufacturing wood pulp by these machines is said to be "mechanical," to distinguish it from the chemical process, in which the fibers are separated (or disintegrated), and not ground. The action of the machines here illustrated and used for the mechanical process will be better understood by a perusal of the following interesting notes on the manufacture of wood pulp, written by J. T. Horton, a member of the Lowville Iron Works Company, who is thoroughly familiar with the subject, and whose experience enables him to write with intelligence:

Almost any soft wood will make wood pulp; the best is made from spruce, from which a stronger fiber is made than from any other, and it is now almost exclusively used. The wood is first cut in lengths to suit the width of stone in machine, from 16 to 24 inches. The bark is then removed by a barking machine, which consists of a disk 4 feet 6 inches in diameter, covered with a case, except a portion or section of the face.

The machinery and the stone *S* of the specialty of building these machines. The members of this firm have devoted much study to this class of work, and with their wide experience have brought out such designs as will rank with the best machines made for the purpose. Fig. 1, in the accompanying illustrations, represents a wood pulp grinder; Fig. 2, a wet machine or press, and Fig. 3, a screen for screening the wood pulp.

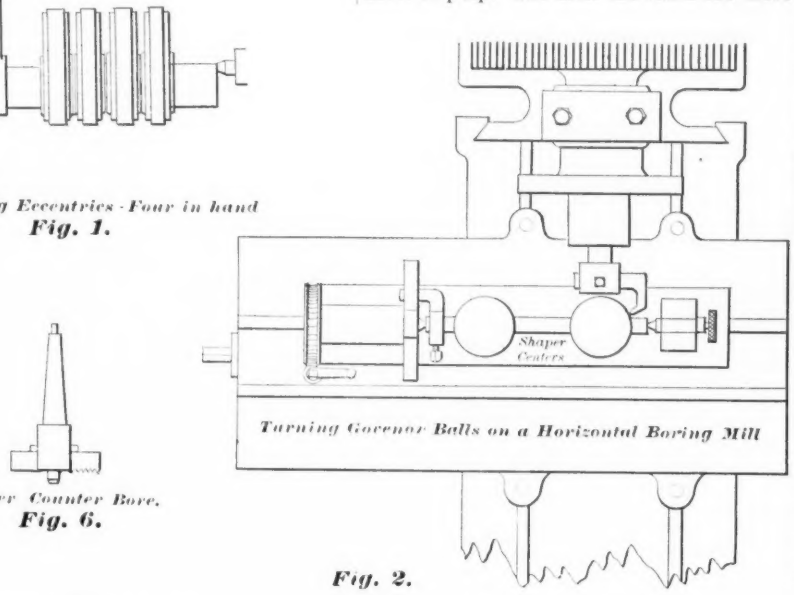
Four or six knives are set in the disk, which runs about 600 revolutions per minute; the wood is laid against the disk and turned around until all the bark is removed, the bark being blown out of the case by blowing wings on back of disk. When a very fine quality of pulp is desired the knots are bored out by a machine something like a speed drill, only made heavier; it is better to remove the knots from the wood, as it takes unnecessary power to grind them (they being much harder than the wood), and the black knots especially, discolor the pulp. After being cleaned, the wood is in some mills soaked in water, making it easier to grind. It is then placed in pocket of grinder *A A* (as indicated), with side of wood to stone, the action being a rub or scrape to take off the fiber, and leave it as long as possible. If the wood is first boiled a stronger fiber will be the result, which will be darker in color. Water is run on the stone in space between the pockets, which washes the pulp as soon as ground into a trough or hollow in the foundation of machine in which the stone runs, the pulp being mixed with water to about the consistency of cream. From there it is conveyed by means of a pump to the screen *C*, Fig. 3, which has in the bottom a brass plate 12x36 inches or 40 inches, into which slots are milled from $\frac{14}{1000}$ to $\frac{30}{1000}$ inch wide, according to the grade of pulp desired. The cam and tappet is used to get the pulp through the machine. The cam shaft runs 125 per minute; the cam has 5 or 7 points, and the screen never has over $\frac{1}{16}$ or $\frac{1}{8}$ inch drop when running, the screw on end of frame being used to adjust the drop; the up and down motion forces the pulp through the screen; after passing through the plates into vat D_2, it flows through B_2 into cylinder vat *A*, Fig. 2. The cylinder is covered with fine wire cloth, through which the water mixed with the pulp runs, and out through valve *N* to waste, the valve *N* being piped to carry it away. As the water flows through the wire cloth on face of cylinder it leaves the pulp sticking to it, and as the cylinder revolves the pulp comes in contact with the endless felt which passes between the coucher roll *D* and cylinder *C;* the pulp as it comes in contact with the felt sticks to it, and is carried over the guide roll *E* (which is used to keep the felt running straight by means of the hand-wheel and screw *O*, the end of the roll *E* being thrown forward or back as the case may be, to bring the felt in the direction sideways). After passing guide roll *E*, the felt carries the pulp between the press rolls *H* and *I*, the pulp sticking to roll *H*. If the pulp is being made for shipment it is allowed to wind on the roll until about $\frac{1}{8}$ or $\frac{3}{16}$ inch thick, when it is cut from the roll, by the attendant, the size of sheet being equal to the circumference and face of roll, which is generally from 40 to 50 inches by 72 inches. It is then folded and done up in 100-pound bundles, averaging 6 or 7 to the bundle, according to thickness and size of sheet. If the mill is in connection with a paper mill, and the pulp is to be made into paper there, the roll *H* is fitted with a knife or scraper the whole length of face, which scrapes it off as soon as formed into a receptacle in front of roll *K*, being carried there by the felt.

The pulp, after passing through rolls *H* and *I*, contains from 50 to 58 per cent. water, according to the amount being made on machine and the pressure put on rolls by hand-wheel. The pulp cannot be shipped perfectly dry, as it takes too much time and trouble to beat it up, when being made ready to run off into paper; and enough pressure cannot be put on rolls *H* and *I* to take out more water than 48 or 50 per cent., as the pulp would not wind on the roll, and the felt would be destroyed, or would not last long. The six-ton spring on upper roll allows for elasticity necessary for the varying thickness of the sheet as it is being formed. The roll *K* is called the stretch roll. It is used to regulate the tension of the felt, both ends being operated by hand-wheel shown, connected with screws by bevel gears. After leaving roll *K*, the felt is taken back to cylinder by passing under rolls *L* and *M* to the squeeze or wringer rolls *F* and *G;* between the rolls *M* and *G* the felt is washed. A pipe (not shown in cut) runs across the machine, resting on the frame, which has two lines of holes $\frac{1}{16}$ inch diameter, holes being $\frac{1}{4}$ inch apart. To this pipe water is supplied from a pump. These jets are directed continually on back of felt. The shaft above roll *M*, with wooden strips fitted to arms, is the felt beater, or washer, which revolves about 160 revolutions per minute, and strikes the felt lightly four times during every revolution, and, in combination with the shower pipe, washes off any particles sticking to it. After being washed the felt passes around and through the rolls *F* and *G*, which removes the water and leaves the felt in shape to take up a sheet of pulp. The drier the felt is the more pulp it will take up. A shower pipe, like the one described above, is also used on the face of cylinder after the felt leaves it, to keep the wire free from any particles that may stick to it.



Turning Eccentrics Four in hand

Fig. 1.



Turning Governor Balls on a Horizontal Boring Mill

Fig. 2.

Baker Counter Bore.

Fig. 6.

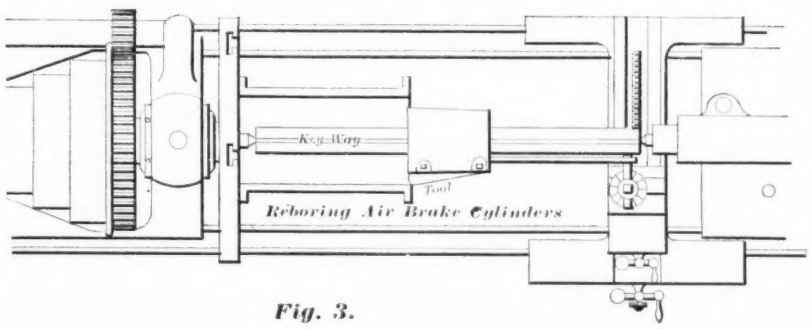


Fig. 3.

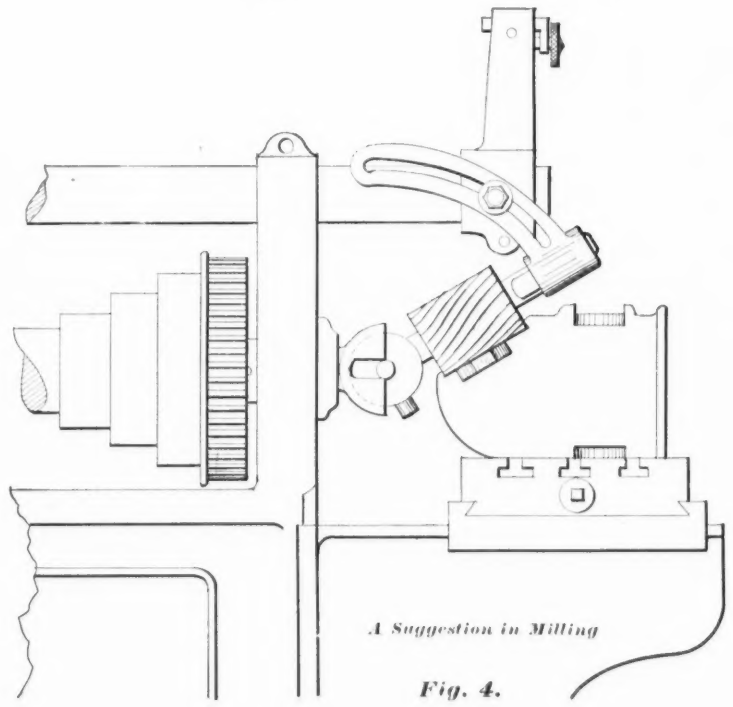
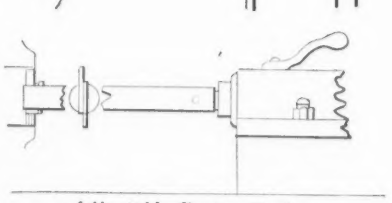
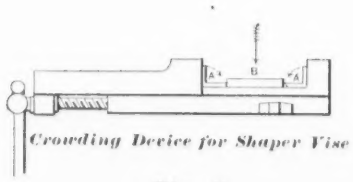


Fig. 4.



Adjustable Boring Tool

Fig. 5.



Crowding Device for Shaper Vise

Fig. 7.

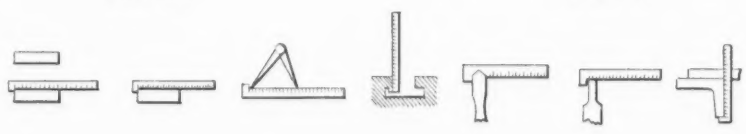


Fig. 8. *Handy Scale*

SOME IDEAS FROM THE SHOPS.

The press rolls *H* and *I* may be made of either wood or iron, as may be preferred. When iron is used, they are chilled; the lower one is generally made of wood, selected hard maple being mostly used. Two heavy cast heads are fitted into end of roll, and are held in place by five rods passing entirely through roll, one 2-inch rod through center of head, and four 1-inch through flange of head. The small rolls are made of white wood.

In making the small rolls a wrought-iron band is first pressed into each end of the stick, and the piece of steel forming the journal driven into it 18 inches. All the journal boxes for small felt rolls are made so that rolls can be removed when changing the felt, by simply lifting out, and not taking out any bolts or screws, the box being open on one side.

The large rolls are removed from housing when necessary, by taking out one bolt in each side, and a piece in front of housing, or frame.

The stones used in grinder are natural, not manufactured, somewhat coarser grit than is used in a machine shop, and the face is kept rough by a device which is bolted to front of machine, which carries a burr similar to that used by a grindstone truing device; this is passed across the face when necessary, which also keeps it true.

One edge of the sectional pocket is kept to the stone as close as possible, and not grind; the other is kept about an inch from stone, to allow water to flow in and wash pulp down to bottom of stone. If iron touches the stone anywhere so as to grind, it discolors the pulp and makes it unfit for use.

LETTERS FROM PRACTICAL MEN.

Some Ideas from the Shops.

Editor American Machinist:

I send herewith enclosed several sketches, which show some operations which I do not find general; perhaps they may be new to some, or suggest something better in place. In Fig. 1 is shown a method employed at the B. & M. R. R. shops at Plattsmouth, Nebraska, for expediting the work in getting out eccentrics. I do not know whether the scheme originated there or not. However, it is a good one, saving time and enabling more uniform work to be produced; the eccentrics are first bored, key-seated and set-screwed, so there is no trouble in securing them firmly to the mandrel.

Fig. 2 shows a neat and effectual means whereby spherical work may be turned on an ordinary horizontal boring mill. The operation which I show is a pair of Corliss engine governor balls, mounted upon shaper centers, which are borrowed for the occasion. The cutter revolves in one position, describing a circle, and the ball is slowly turned by worm gear. After being roughed out and finished as near as possible on these centers, they may be put in the lathe for polishing, after which operation they should be chucked in the steady rest, and drilled for stem; then they are cut off, leaving a ball practically round, and balanced. Any one possessing a horizontal boring mill can with very small expense equip the same for doing a large variety of milling. With a pair of good shaper centers we can cut gears, mill taps, reamers, etc., and in fact do many things not desirable to do on a small machine.

In the Pueblo shop of the D. & R. G. R. R. shops they have an effectual method of reboring air-brake cylinders, as shown in Fig. 3, on the lathe; a dog, not shown, is attached to the bar, to keep it from turning.

Fig. 4 shows a departure in bevel milling; it is merely given out as a suggestion; there seems to be no reason why it could not be adopted for some work.

Fig. 5 shows an adjustable boring tool for tail-stock or turret. This scheme ought to be old as the hills, but as yet I have never come across one. The arrangement as shown consists merely of sliding cutters, which are intended to be adjusted in a hole already bored to size, which will insure it working central on succeeding ones. If the cutters be threaded they may be used as a tap as well.

Fig. 6 shows a counterbore for large diam-

eters, one side being notched, and extending a small distance below the opposite cutter, which is smooth in operation; the notched side takes hold of the scale much better by being roughed, and leaves a surface of which the smooth cutter readily takes hold; the notched side, of course, being the lowest, leaves grooves or rings in the surface. For ordinary purposes this will be no objection; if so, two pair may be used, one for roughing and one for finishing.

Fig. 7 shows a neat little scheme for holding work down on a planer or shaper vise, consisting of two pieces of angle iron or steel abutting the work and chuck, the illustration will no doubt fully explain the intent.

Fig. 8 represents a very handy scale which I made by milling a 12 scale so as to give me a notch on the end; having used it now for over a year, I don't see how I could do without it. It seems as though something of this nature should be in the market. In proof of its handiness I append some of its uses. I think some blacksmith originated this form of a scale, as they nearly all use them where they can get them.

L. C. Sharp.

Old Steel.

Editor American Machinist:

A paragraph on the first page of your issue of March 26, regarding the affinity existing between the newspaper reporter, the steel of olden days, and the workers therein, reminds me of what I once had the pleasure of listening to.

I was a member of the senior class of one of the foremost colleges in New England, over which there presided a man of national, if not international, reputation, as a thinker on theological subjects, and one whom we looked upon as possessed of all knowledge. At that time he had a theory that Adam was created with the knowledge of all things, and that humanity has been deteriorating ever since. This he could clearly prove to his own satisfaction. Among other assertions falling from his lips was this: "Steel is acknowledged to be the highest product of the chemist's art, and the indication of the highest civilization; yet, though Germany ranks highest in civilization, and the thoroughness of her researches into synthetic and analytical chemistry, the best steel of the world is made in India, and has been from time immemorial."

Fortunately, there was not a student before him at the time that had ever heard of mild or tool steel, or anything but steel; so there were no disagreeable questions asked, since our sole knowledge of the metals had been derived from Homer's descriptions of the tools and weapons of ancient Troy. But these college professors, who educate boys classically, seem slow to learn that there is anything but a Toledo blade fit for a sword, and when some æons have passed, perhaps their successors will delve into the records of the long forgotten nineteenth century, and gravely discuss the work of one Bessemerius, the Siemenese.

Geo. L. Fowler.

Armor Plate Mill.

Editor American Machinist:

Most of your readers perhaps know that the Homestead Steel Works have secured a contract from the U. S. Government for a quantity of steel armor plate, and they are now rebuilding their armor plate roll train for this purpose.

The mill will be somewhat of a novelty in this country, perhaps, on account of the peculiar arrangement of the rolls. It will be a single stand of four high rolls, the top and bottom rolls 32 inches diameter, and the two intermediate each 24 inches diameter, and all will be 110 inches in length of body between the bearings. The armor plates will be rolled between the two intermediate rolls, passing back and forth, until reduced to the desired thickness by reversing at each pass the engines which drive the rolls. Only the two small rolls will be driven, the large ones acting as friction rolls, and also serving to reinforce the small ones.

The advantage of this arrangement is, that it requires less power to roll with the small diameter rolls, and smaller engines will do the work.

The pair of engines that drive the train are 40-inch bore, 54-inch stroke, Reynold-Corliss.

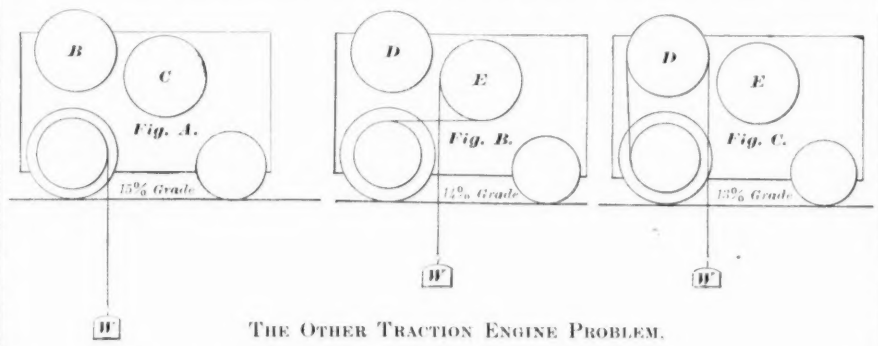
The housings which carry the rolls are each 19 feet 11 inches total height, and weigh 43 tons each, without any of the fittings which belong to them. They were cast in cores, and the iron for them melted in air furnaces. The two top rolls will be balanced, and can be raised high enough to start on an ingot 38 inches thick, and reduce it to any desired thickness. A pair of vertical rolls driven by another pair of engines keeps the plate to the desired width while being reduced. The housings and fittings for this train are being made by the Robinson-Rea Manufacturing Company, of Pittsburgh, Pa.

R.

The Other Traction Engine Problem.

Editor American Machinist:

A. H. Lefebvre's three diagrams showing the application of the driving power to the main drivers of a traction engine at three different points would at first seem to upset all our preconceived notions. Still, as in such a question the question of friction is omitted, we must admit that we have been mistaken, or show why the result in practice is so much at variance with the theory. Is not the difference entirely due to certain friction, which the experimenters have failed to recognize? In Fig. *A* there is no weight on the four main journals of the engine, except the weight of the engine itself. As arranged in Fig. *B*, the weight on the main journals is the weight of the engine plus the weight *W*, which (as I understand it) is three times more, and, in addition to this,



The Other Traction Engine Problem.

there is additional friction on the main journal due to the pull, which equals nearly the weight *W*, and the friction on the idle pulley journal equal to one and five-twelfths the weight *W*. These frictions ought to make quite as much difference as shown. The additional friction in diagram *C* is twice the weight of *W* on the main axle, and twice the weight *W* on the idle wheel. Why the difference between *B* and *C* should equal that between *A* and *B* I do not understand. The test between the two forms *B* and *C* is fair, but in the case of *A* it is not fair, because in that case the power is not applied as if coming from the engine itself. There will be a difference in an actual engine whether the power is applied at the front or back of the driving wheels, because if at front, the friction on the main journals will be that due to the weight of the engine *minus* the strain on the second shaft journals, and if at the back, that due to the weight of the engine *plus* the strain on the second shaft.

To apply this to the other question about lifting the front of the engine, so long as the weight of the engine remained the same, and the center of gravity remained the same distance ahead of the rear support, the location of the gearing would not change the lifting tendency, except as it too might bring in an additional friction influence.

J. G. Tramis.

Pumping Hot Water.

Editor American Machinist:

I see by a recent issue that President Cronley states that no pump, however good, can raise hot water. Now for the benefit of the readers of the American Machinist will say we have at our works a 6″x4″x6″ Worthington boiler feed pump that lifts water three feet at a temperature of 170° F., and we have no trouble with it, and it runs every day feeding our boilers.

C. J. Mullaney.

[When it is said that a pump will not lift hot water, it is meant that it will not lift water so hot that the steam thrown off from it prevents the pressure on the surface of the water in the suction pipe from falling below that of the atmosphere. Water at 170° is not hot enough to do this, and it can therefore be lifted the distance named, though it could not, perhaps, be lifted much higher by the same pump working under the same conditions. Mr. Cronley meant water nearly or quite 212°, and it is a good rule to arrange things so that hot water flows to a pump by gravity.]

A Question in Shop Ethics.

Editor American Machinist:

Here is the story of an actual occurrence, the ethical questions involved in which I desire to submit to the judgment of your readers.

In a certain experimental workshop with laboratory attachment, a young man is employed as assistant, and put in charge of a floor, the 4th floor in the building. The city water does not usually rise to this floor, and a tank is put in, to which the water is forced up from a lower floor through a flexible tube. Plumbers are called in, and they make a solid pipe connection in place of the flexible tube. The young man in charge goes round after the plumbers have finished their work, sees that everything is right, turns off all the water cocks on the 4th floor, through which water might come if the city water should happen to rise to their level during the night. He neglects to see, however, that one of the cocks has a small vent hole in it, which is left open. The water does rise during the night, and flows in a small stream through the vent hole, floods the floor, and damages the ceilings of the floor below. The employer next morning holds the young man responsible for the damage, and says he must pay for it, demanding $100 in cash. The employe, receiving only a small daily wage, has not the money, and the employer generously offers to take a long time note for $150 instead of the cash. The young man being inexperienced in matters of this kind, and deeply regetting that his neglect to see the small vent hole should cause his employer any loss, signs the note, although he believes that $150 is far more than the amount of the damage done. To console the young man for the damage to his feelings, the employer tells him that it will be a good experience for him, that he will not again be so negligent, and that some day he will thank him, the employer, for having made him pay for this experience.

After the young man signed the note, and had time to think it over, he regrets having signed it, and thinks his employer has been guilty, not only of meanness, but of extortion, and he asks my opinion on the matter. I have my own opinion on it, but desire to have the verdict of a larger jury, and so turn the case over to the readers of the American Machinist. Here are some of the questions it involves:

1.—In accepting work at a small wage, which wage is supposed to be a compensation for work done, and for attention given to the interests of the employer, does the workman insure the employer against the damage done through his accidental neglect?

2.—If this question is answered affirmatively, and the workman causes by his neglect a damage, which is more than he can pay, is he under either a moral or a legal obligation to sign a note agreeing to pay for the damage at some future time?

3.—If both of the above questions are answered negatively, then is not the act of the employer an act of extortion, and the note void, as issued under a misapprehension of indebtedness, and without equivalent consideration or value received?

4.—In such case, would the employe be morally or legally justified in refusing to pay the note when it came due?

I know most of the readers of the American Machinist are not lawyers, but if they cannot give the true legal answer to the above questions, they can answer them as men of common sense, some from the standpoint of the employer, others from that of the employe.

Technics.

"An Industrial University."

Editor American Machinist:

As a constant reader of your valuable paper, the heading of the article "An Industrial University," by Prof. John E. Sweet, in the issue of March 12, attracted my attention at once. The professor deplores that we have to rely on foreign countries to furnish us with our best mechanics, while our home talent is deteriorating from year to year, partly because the employers of labor in this country are averse to the old apprentice system, and because the parents object to binding out their sons for a term of years to learn a trade. The professor starts in by dismissing the old apprentice system as a worn-out subject, without as much as one word in its favor, yet that old system has given us what home talent we do possess, and, by the way, be it remembered that this home talent stands second to none in the world, as proved every day by the peculiarly exact American system of working, established by the man the old apprentice system has given us.

Not one word has the professor to say as to the cause of the evil he deplores, and, judging from the method he would employ to manufacture machinists to order; machinists who could do instead of think, and the pleasure he manifests in having found, as he thinks, the means of destroying the influence of trades unionism, it is evident that he does not contemplate raising the general standard of the men employed at the trade. The very nature of such an institution as he recommends would and could, under present circumstances, only accommodate a favored few, comparatively speaking, and even those few the professor proposes to educate with instructors at small salaries. Now the professor certainly knows that cheap and nasty always go together, and that instructors satisfied with small salaries are not worth the pupils' time spent in paying attention to what they have to say, or happen to know by accident. And to cap the climax, the professor would stimulate his pupils, and show them the value of time, by putting them to work on the piece-work plan, a system of working recognized by every thorough and fair minded mechanic as the prime cause of reducing a once proud and independent class of industrial workers to the point where they are the servants instead of the masters of the machine.

The proprietors of our industrial establishments certainly do not favor the apprentice system. With them it is a question of dollars and cents, and it is cheaper to hire a boy at a few dollars a week to work on a certain class of work, as long as such work is in demand, and to get rid of him as soon as such demand ceases, than to be bound by contract to advance that boy step by step and make a mechanic of him.

The parents' objections to binding out their sons for a term of years to learn a trade at which, after years of hard work and study, such sons will be able to command $2.50, or at best $4 per day, explains itself, when we take into consideration that a boy endowed with the necessary intelligence to make a first-class machinist can become sufficiently versed in some of the professions, by devoting less time, muscle and brain

work, not only to earn a much better salary than he possibly could as a machinist, but earn it with less physical exertion and pleasanter surroundings than the hum and noise of a machine shop. This same objection of the parents would always hold good, no matter what kind of a university the professor would build and equip for us.

If the professor is sincere in his wish (and I have no reason to doubt it) to better the conditions of the machinist trade in this country, and get the parents to encourage their sons to bind themselves out to serve their time, as of old, he can be of much more service if, instead of devising means, as he evidently has an idea he is, to destroy the beneficent influences of trades unionism, he will devote his eminent talents and influence to pointing out imperfections of the trades unions so that they may be remedied, and help bring them to a better understanding of the truth that the interests of employers and employes are one and the same; if he and others will help raise the general standard of the workers in the trade, give them a fairer share of what they produce, and make a fair adjustment of the time required to produce the necessities and comforts of life in proportion to the improved means of production, it will be unnecessary to bother about manufacturing machinists to order. It will not be necessary to resort to the methods of training boys how to do, instead of how to think, in an industrial university.

An Old-school Machinist.

"Teaching Trades in Reformatories."

Editor American Machinist:

Your editorial in the issue of March 26 invites comment. About the first paragraph there is no question. Skill, acquired by years of practical experience in a machine shop, as the capital which is in no danger of serious contraction, cannot be discounted by any amount of knowledge acquired elsewhere, whether it be in an industrial school or in reformatories.

Society would not, of course, have incurred the obligation to instruct young men who have been confined in reformatories, in the trades, had they been law-abiding, but finding it necessary to protect itself, as the first law of nature, should it not, in return, make some sacrifice for this necessary evil? Should the instruction be elective, it would not be venturesome to say that the trades would receive the greatest number.

Right and wrong are often construed for convenience and inconvenience. Surely the State does not declare that honest and useful lives are not possible without trades, but it maintains that trades are valuable expedients as restoratives; that usefulness is commensurate with occupation.

You state that the condemnation by the press of the action of the Boston plumbers, in objecting to the teaching of their trade in the Concord Reformatory, is severe and prejudiced, yet you do not present another side that you claim. You know that it would be impossible to give the necessary instruction to one confined in a reformatory to fit him for the practice of medicine. In Europe the instruction in medicine is more thorough than it is in this country. It requires years of study and application before the law will permit one to practice, the advisability of which is gaining weight in our own country. Disease in reformatories is guarded against as much as desertion and instruction would be only theoretical. Imagine one instructed in diplomacy in a reformatory, treating, should it be possible, with one from Europe or South America. There is a relation of values recognized about questions of education for youth. What would be the relative value of the instruction in a profession received at a reformatory to that of a trade?

The men who wear overalls or aprons have rights equal to, and as many as any other class of citizens. Taxation, it seems to me, is the greatest incumbrance, and this their suffrage can repudiate. It is significant that the trades—to be definite, the machinist trade—is tending upwards in the estimation of the public, as witness the establishment of industrial schools, and the bequests to perpetuate the same; the disposition of employers to share the profits with the employes; the daily and illustrated papers personifying honesty and kindness in the sturdy mechanic.

You are surely justified in championing the cause of the mechanic, for it is true that the press, in general, is not impartial in its discussion of such questions, and it is commendable in the American Machinist to protect their interests. Albert S. Cox.

Boring Thin Bushes.

Editor American Machinist:

I would like some of the readers of the American Machinist to describe their methods of holding light brass bushings for boring and turning. The bushings are 5½" long, 3⅛" bore, and 3¾" outside diameter. They are in halves, their faces being soldered together.

In reply to Mr. Colvin's criticism about filing a commutator, I will say that I know it is not a good plan to do so, but then, if you want to finish one up by turning, you have to use a very fine feed, because, if you use a broad-nosed tool it will chatter and tear the copper, leaving it rough. The last one I finished by taking off the feed pulley and putting a collar about one-half the size of the pulley on the stud, turned with a narrow-nosed tool, and smoothed up with fine sand paper. I would like Mr. Colvin or any one else to give further information.

C. S.

Correct Forms of Slide Rests.

Editor American Machinist:

I should be pleased to hear the opinions of some of your readers as to the best form of slides and adjusting strips for slide rests, milling machine table and machine tools generally. Of course the main object is a maximum of rigidity with a minimum of expense in fitting.

During the last four days I have been experimenting on the rigidity of slide rests by some of the best makers in America and England, and have been quite surprised at the amount of "spring" observed in every instance. Doubtless a large amount of this is due to inevitable elasticity of the material, but still there is lots of play at the fitting surfaces as well.

To test this, screw a three-foot steel bar in the tool-post, and get some one to wrench the end up and down, and watch results. The amount of movement noted appears to be slightly greater in the American style of slide rest than in the English, but no attempt was made to measure the movement except by the eye.

The almost universal form of slide adopted by American makers appears to be as shown in Fig. 1, a narrow steel packing piece being employed, set up by cheese-headed screws.

Fig. 1.

Fig. 2.

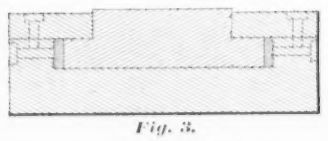


Fig. 3.

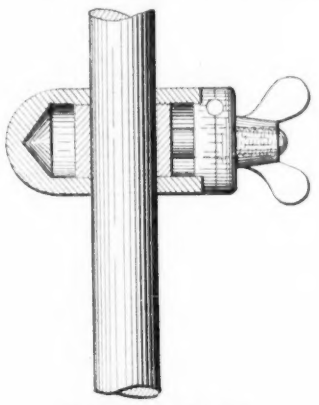
Slide Rests.

Here [in England] on the contrary the usual practice is shown by Fig. 2, in which a wide cast-iron strip is used, drawn tightly up to the slide by screws, and adjusted by square-headed screws and lock nuts at the side—of course this construction is more costly, but is it not somewhat more rigid?

There is also another point on which I would like to hear an expression of opinion. American makers are in almost every instance content with making slides of the form shown in Fig. 1, to bed only at *X X*, whereas over here, the leading makers invariably make their slides bed both at *X X* and also at *Y Y*. Now is there any argument against the latter arrangement?

Probably the most rigid of all forms of slides is the square, as shown in Fig. 3, and this appears to be coming more and more into use in America on shaper rams and in capstan (or turret) lathe work, but this form costs lots of money to make, and is not applicable in many cases where space is cramped.

I am persuaded that there is a good deal to be learned even on a simple subject like the above, and it is just this sort of knowledge that is most useful to every-day mechanics like "Anglo-American."



A Surface Gauge.

Editor American Machinist:

Mr. Chas. S. Beach's sketch of a "surface gauge" prompts me to send the enclosed sketch of one I saw several years since. Although not new to some, perhaps it may be to others. Its simplicity of construction recommends it. S. R. H.

Changing Speed of Engine.

Editor American Machinist:

If J. B. W., (Questions and Answers, No. 131), will increase the diameter of governor pulley, he will obtain the desired speed without any other change. Multiply the diameter of pulley on engine shaft that drives governor pulley by the number of revolutions you wish the engine to make, and divide that by the number of revolutions the governor pulley makes before the change, and the quotient will be the diameter, in inches, of governor pulley.

Wm. E. Bassett.

[We supposed at the time we answered the question referred to, and do now, that the requirement was that the machinery should run at the same speed as at present, which would call for a change in pulleys or gearing.]

"Foundry Management."

Editor American Machinist:

Mr. David Spence, in your issue of February 5, writing on the above subject, says: "In a foundry doing a regular line of work, the foreman should have a day-book, with each man's name, wherein to tally the number of flasks put up, and weight of castings made."

As most foundries doing a regular line of work use the piece-work system, I fail to see the utility of tallying the number of flasks put up per day, as the castings must be counted and weighed, thereby giving the result sought for, namely, pounds per man.

The foundry of which I am in charge at present is what would be termed a jobbing shop. Besides our own engine and general saw-mill machinery castings, we do work for a dozen other machine shops, and, by the use of time sheets, can find out in a few minutes the cost per pound of molding, or total cost.

The time sheets are furnished the men in numbers of twenty-five at a time, or about enough for one month's use. As each man has a cupboard, he is required to keep his sheets in good order, and they are filled out at blast time. The time sheets are then deposited in a box kept for that purpose, from which the timekeeper gets them the following morning. After putting them together, and placing each molder's number on his time sheet, they are transferred to the man that weighs the castings.

The object in numbering the molder is to enable us to put a corresponding number on his time sheet; to facilitate the handling of the sheets when weighing, etc.

To make it easy for the man to correctly fill out his time sheet, we use pattern cards. For instance, we will say, I give R. H. Marshall the pattern for a front cylinder head to mold. On this pattern he finds his order as per duplicate here given. This shows reverse sides of foundry order:

FOUNDRY ORDER.

Milwaukee, 2—14, 1891.

No. Pieces.	NAME OF CASTING.	No. of Casting.	Core.
2	Front Cyl. Heads. B.	243	Special.

Order No. 05196.

Molders must keep accurate account of all work assigned them on this slip. Time on castings made in excess of orders, or not according to orders, will not be paid. This order must be returned to office, and patterns sent out as soon as order is completed.

DATE.	Castings Made.	Castings Good.	Castings Bad.
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

After the castings have been weighed up the following day, R. H. Marshall's time sheet will be returned to the office and appear as below:

No. 44. *Time of R. H. Marshall for the 14th day of Feb., 1891.*

Order No.	Pieces Made.	Name of Casting.	No. of Casting.	Hours Molder.	Hours Helper.	Good Castings. Pieces.	Good Castings. Weight.	Bad Castings. Pieces.	Bad Castings. Weight.
05196	2	Front Cyl. Heads. B.	243	10	6	2	822		

☞ Don't write below this line.

George O. Vair.

James H. Reed.

James H. Reed, of Detroit, Mich., Past National President of the Marine Engineers Association, died, on March 31, of heart failure. Mr. Reed was an old-time mechanic, and a marine engineer of well-known ability. He was a man who made warm personal friends of his acquaintances, by whom he will be missed no less than by the association that always had his best efforts in its behalf.

AMERICAN MACHINIST

Communications relating to the reading columns should be addressed to the Editor. All other communications should be addressed:

AMERICAN MACHINIST,
96 FULTON ST., NEW YORK.

PUBLISHED WEEKLY AT
96 Fulton Street, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

Subscription.

$3.00 a year in advance, postage prepaid, in the United States, Canada, and Mexico.
$4.00 a year to Other Countries, postage prepaid.

Advertising.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

The American News Company,
Publishers' Agents, New York.
The International News Company,
BREAM'S BLDG'S, Chancery Lane, LONDON, E. C., ENG., will receive subscriptions for the AMERICAN MACHINIST, at 16/6 per annum, postage paid.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Buffalo News Co., Buffalo, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

Subscriptions received in Australia by W. WILLIAMS, 17 and 21 Fink's Buildings, Melbourne.

NEW YORK, APRIL 9, 1891.

CONTENTS.

	PAGE.
Eighteen and Twenty-one-inch Screw Machines	1
On Keeping Shafting in Line. By Peter H. Bullock	1, 2
Finding Change Gears for Odd Pitches. By George B. Grant	2
The Briggs Standard	3
Conveniences in the Machine Shop. By A Mechanic	3, 4
Machinery for Manufacturing Wood Pulp	4, 5
Letters from Practical Men: Some Ideas from the Shops. By L. C. Sharp—Old Steel. By Geo. L. Fowler—Armor Plate Mill. By R.—The Other Traction Engine Problem. By J. G. Tramis—Pumping Hot Water. By C. J. Mullaney—A Question in Shop Ethics. By Technics—"An Industrial University." By An Old-school Machinist—"Teaching Trades in Reformatories." By Albert S. Cox—Boring Thin Bushes. By C. S.—Correct Forms of Slide Rests. By Anglo-American—A Surface Gauge. By S. R. H.—Changing Speed of Engine. By Wm. E. Bassett—"Foundry Management." By Geo. O. Vair	5, 6, 7
James H. Reed	7
Praise for our New Navy	8
A Triangular Fight	8
Shun Them	8
Literary Notes	8
Questions and Answers	8, 9
Manufactures	9, 10
Mechanical Skill and Wages	10
Composition Condensers for the U. S. Cruiser "Maine."	11
Sweeping Conical Winding Drums. By P. S. Dingey	11
Machinists' Supplies and Iron	11

Praise for our New Navy.

Our new naval vessels are receiving unstinted praise from a member of the British Institute of Naval Architects, Mr. J. H. Biles, who was in this country a few months since, and after having opportunities of seeing about all there was to be seen here in the way of naval construction, spoke in the highest terms of admiration of what he had seen at the various shipyards and arsenals, and expressed great surprise that the intricate problems presented by modern naval construction should have been so readily grasped here. Had this been all, we might have thought that some of the complimentary things said by Mr. Biles, while here, were due to a desire not to appear rude to hosts who had evidently done everything in their power to render his visit pleasant and profitable. But upon his return to England, it seems that Mr. Biles did not hesitate to praise the work accomplished here as warmly as while in this country, and according to a press cable dispatch he said before a meeting of the Institute of Naval Architects that the naval constructions here quite equaled, and sometimes surpassed European constructions of a like nature, and that the latest American naval vessels were well worthy of careful study. The London correspondent of the New York *Times* says that at a recent meeting of the Institute the result of a hostile demonstration by an Italian man-of-war on the American coast was discussed, and the general opinion seemed to be that it would be a very disastrous thing for the Italian, and that it was from the latest American work that most was to be learned by naval constructors. All of this is very pleasant, for while there may be differences of opinion as to the necessity or advisability of having a new navy, there is none as to the desirability of having the best possible one, so long as we are to have one at all. And evidences are not wanting, that if our new navy does not lead us into some indiscretion, or, in other words, to the carrying of a metaphorical chip on the shoulder, its general effect will be good, for the building of it is undoubtedly doing very much to stimulate advance in a class of metal work in which we have been sadly deficient.

A Triangular Fight.

Railroad employes do not hesitate to engage in fights with the companies by whom they are employed, but when it comes to a fight of the companies against some other foe, the men are always on the side of the companies. Thus in the West, railroad employes are of the opinion that hostile legislation—granger legislation they call it—is inimical to railroad interests, and has so far depreciated stock as to render dividends impossible. Hence the employes are combining to fight—politically—the grangers.

No part of the country has been more benefited by railroads than the West, notwithstanding which there has been a good deal of legislation there that has the appearance of being hostile to them. By all means, if railroad companies are not disposed to do right, let them be compelled by law to do so, but legislation simply to spite and hamper them, or to reduce their earnings below what is equitable, is not only unjust, but it is extremely unwise.

After all, there is probably a good bit of selfishness in the organized political fight which the western railroad men propose to make. In one instance, at least, in the preamble of one of the associations is the following: "Reducing the force of employes, and shortening the hours of labor is the rule [of railroad companies] in an effort to keep the expenses within the income."

We suspect the foregoing has a good deal to do with the organizations referred to, but that is not saying that there is anything blamable about the matter. These railroad employes are fighting, not so much for the railroads, as for an opportunity to work to the end of getting a living, and it is quite natural—whether wise or not—that they meet organized attack, or what they believe to be such in effect, by organized opposition.

The railroad companies are not likely to object to such organizations of employes. It is the companies' chestnuts that are to be pulled from the fire. The worst aspect of the case, so far, is that a good many railroad employes, including machinists, blacksmiths, carpenters and boiler makers, are finding themselves out of work.

Shun Them.

This country is full, so to speak, of "fraternal" benevolent associations which appear to have taken their cue, in attaching some kind of an insurance feature to their organizations, from the practice of associations that have good reason for continued existence. That is, to put it plainly, designing men in all parts of the country, seeing that the insurance feature of some of the really meritorious associations was popular, have brought out the most flimsy apologies for associations upon which they could engraft some remarkable insurance scheme, or some wonderful giving-something-for-nothing feature.

The money that fosters these humbug associations comes, for the most part, from working people—men and women—who do not stop to think that insurance, like everything else, if good for anything, must be bought and paid for at its full value, or that it is impossible for an association to go on paying out ten dollars for every five dollars received.

It is a satisfaction to know that some of these undesirable associations are being brought to grief by the authorities of the States in which they do business. The harm they have done cannot be undone; the next best thing is to prevent the further harm they may do. In the meantime, no working man or woman should give any heed to an association or company that promises insurance for, practically, nothing, or that agrees to return the money they may invest, in two or three years, with interest at twenty or thirty per cent. Insurance companies, both life and accident, have got the business of insurance figured down fine. They know the probabilities so closely as to make no mistakes in fixing rates. And as for interest, any one who has proper security can get all the money he wants at a low rate. A moderately high rate of interest generally means danger of losing both interest and principal; an abnormally high rate means just about the certainty of doing so.

We have nothing to say against the benevolent features of organizations that have legitimate reasons for existence. In many instances much good is done through these features of such organizations. It is only, as before intimated, those organizations or companies that propose to sell money for less than its value that we warn those who work for their living against. No attention should be paid to the plausible stories told by their circulars, or otherwise. They should be shunned.

We recently saw three new steam engines—two of perhaps one hundred or more horse-power, and the other somewhat smaller—standing outside a building in which they were probably to be eventually used. These engines had, to all appearances, been standing where they were, entirely unprotected from the weather, for a month or two at least, for all the machined parts in view were covered with thick rust. Probably when they are put in place this rust will be scoured off with emery cloth, some of the emery working into the bearings, and together with some oxide of iron, causing trouble at starting up. Then the builder will get blessed, and perhaps be compelled to send a man some hundreds of miles to determine why his engines don't run cool.

The Carpenters' Council of Chicago, and the Builders' Association, have come to an agreement providing for the settlement of differences during the coming year by arbitration. Eight hours will constitute a day's work, the minimum wages being 35 cents per hour. This agreement to settle differences by arbitration is much more sensible than strikes and lockouts.

Literary Notes.

A Descriptive Treatise on Constructive Steam Engineering. Embracing Engines, Pumps and Boilers, and their Accessories and Appendages. By Jay M. Whitham, M. E., C. E., author of Steam Engine Design.

This work is mainly devoted to the description of all classes of steam engines, boilers, pumps, and their accessories. In the opening chapter, a brief classification of the various types of engines is given, and then follows a chapter on heat and steam, embracing thermometers and calorimeters. The other chapters contain descriptions and illustrations relating to engines of popular design, including the simple, compound, triple and quadruple expansion types. The classes of engines shown embrace the stationary, marine, pumping and fire engines. Many details are shown separately, giving the latest and best practice in steam engine construction. Different kinds of indicators, indicator rigs and diagrams are described and illustrated. The manner of finding the indicated horse-power from cards, and the steam used per indicated horse-power from cards is explained. The chapters treating on Zeuner's method of analyzing valve gears as applied to the design of slide, Meyer, Gozenbach and other valves, with examples; and setting valves with and without the indicator; operating engines and pumps, engine trials and dynamometers, are very instructive. The various types of boilers, and the theory of combustion are discussed; and the last chapter relates to all of the appendages and accessories of boilers, their decay, management, etc. The subject of designing engines and boilers is not discussed, the aim is simply to point out and explain the constructive features of engines and boilers, and everything connected with them, and this we believe has been done exhaustively. Many of the illustrations have been taken from catalogues and technical journals, so that the appearance of the work may convey an impression that it is a first-class catalogue. But it is more than this—it contains much valuable information and interesting matter relating to steam engineering, presented in plain language, so that it can be easily understood by all who are interested in the construction of engines and boilers; the whole matter is arranged and stated in a manner which cannot fail to be beneficial and of service to mechanics, draftsmen and all others who wish to study the latest improvements in, and the constructive features of steam engineering. The book contains 795 illustrations, and 900 pages. It is published by John Wiley & Sons, 53 East Tenth street, New York. Price $10.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(157) C. P. S., ——, writes: Please inform me if increasing the size of an eccentric will alter the throw of the valve. *A.*—No. 2. Please also give me a rule for setting the foot-stock of a lathe to turn taper. *A.*—You will find this in the answer to Question 168.

(158) G. T., New York, writes: I made a die $\frac{1}{4}''$x$2\frac{1}{2}''$, and when I hardened (?) it, it was just as soft as before. Others tried it, but it would not harden, though it was marked on the bar "Cast-steel." Can you explain the difficulty? *A.*—The steel may have been mistreated in some way before you attempted to harden it, either in forging or annealing, or, it may have been so low in carbon as to harden with considerable difficulty. The only way to avoid such difficulties is to get the steel of a well-known maker, and be guided by his directions, largely, in handling it.

(159) A. H. R., ——, asks: Will you please give me a receipt for making an oil suitable for guns and sewing machines, that will not gum. I wish to make only a small

quantity, not to exceed a quart? *A.*—Take good Florence olive oil, and put it in a bottle with some strips of zinc and shavings of lead, which should be clean. Expose the bottle to sunlight until the curdy matter ceases to be deposited. This will require considerable time, but the oil when decanted will be of very fine quality, and will not gum. A mixture of sperm oil and paraffine oil will also be found to be very good in this respect.

(160) D. S., Schenectady, N. Y., writes: Will you settle a question which has arisen between my friend and myself? I claim that the crown of a pulley is the amount that the center of the face is higher than at the sides, or, one-half the amount that the diameter at the center exceeds that at the sides, while he claims it is just twice that. Which is right? *A.*—You are right. 2. Please also give the proper place to measure the diameter of a pulley; at the center, at the sides, or half way between. *A.*—Half way between would probably be most correct, though we believe they are usually measured in the middle.

(161) W. O. P., ——, asks: How are holes punched in sheet-metal so as to have clearance? I have seen some sheet-metal punched with oblong holes which were larger on one side than the other, and the work showed that the punch went in from the small side; I can think of only one way to do this, but my friend thinks it is not practicable. Can you tell us how it is done? *A.*—It is done by making the die larger than the punch. The under side of the hole is thus made the size of the die, while the top is the size of the punch. Of course this will work only within certain limits, depending upon the character of the metal punched, and its thickness.

(162) H. D. P., ——, asks: What method, if any, has been used for finishing the threads of taps, standard thread gauges, etc., after hardening? *A.*—We do not know that such a method has been used for taps, but for standard plug thread gauges Pratt & Whitney have ground the threads by a wheel charged with diamond dust, fed at the proper rate, the same as a lathe tool. 2. Would such a method in your opinion be useful to the manufacturers and profitable to the inventor? *A.*—It would depend entirely upon what the method might be. If it secured entirely satisfactory results within reasonable limits as to cost it might prove useful and profitable.

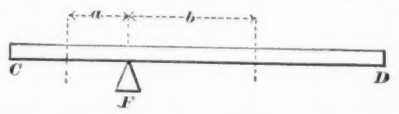
(163) W. G. M., Gainesville, Ga., writes: How can case hardened set-screws be annealed so that they can be drilled? *A.*—They can usually be annealed in the ordinary way in which steel is annealed, *i. e.*, by heating to a low red heat, and cooling very slowly. 2. In what manner should I proceed to balance a pulley at a given speed? *A.*—Pulleys are not usually balanced with reference to the speed they are to run at, since, if they are really balanced, they will run at any speed. Put them on an arbor, and place the arbor upon two straight-edges parallel with each other and level. Stick clay to the rim of the pulley inside, until it will stand in any position or stop in any position indifferently. Then rivet a piece of iron weighing the same as the clay to the same point in the rim.

(164) A Worker, ——, asks: What is the meaning of the term lap, used in connection with hardened pieces of steel that have been sprung in hardening, and how is the process performed? *A.*—A lap is anything which is of such material as to hold grinding material, which may be emery, diamond dust or other abrading material. For instance, a flat piece of cast-iron becomes a lap when flour of emery and oil are placed on it, and a piece of hardened steel that has been sprung and is to be ground straight again is rubbed over it. For grinding out holes, they are made cylindrical, of lead, wood, cast-iron or steel, and run in a lathe. For cylindrical work it becomes simply a hole which is made in any of these metals, and usually has some means of closing it on the work as the grinding proceeds. You will find some points on lapping in the answer to Question 114, issue of March 5.

(165) R. B., ——, asks: Will you please give me the rule for figuring the gears to cut a screw of three-quarter inches pitch, with a lead screw of five to the inch? Please do not refer me to any back number, because I have seen all the rules, but none with five to the inch. *A.*—This question is typical of many that we receive, and we explain our position upon it for the benefit of others. We cannot, for obvious reasons, undertake to publish a separate rule for every pitch of lead-screw and every thread that is to be cut. If we were to do so we should do an injustice to others who are waiting to have their questions answered. Besides, there is no need of it. In the answer to Question 121, issue of March 12, a rule is given which covers any pitch of lead-screw, and from which by a little study you can figure the matter out. 2. Please give me the way to find the correct length of the eccentric rods of a locomotive. *A.*—This cannot be done without drawings, and we have published these, and explained the matter in full in our issue of May 17, 1884, which may be obtained through any newsdealer.

(166) J. G. M., Three Rivers, Mich., asks: What is required of one in order to become a member of the American Society of Mechanical Engineers? *A.*—You will find this question answered in issue of January 22, Question 46. 2. What method is used to grind a taper reamer to a true taper? I have a set of new Morse taper reamers, no two of which are the same taper. I can grind the reamer to a true cone, and then set over to bring the relief true, but the ordinary way I believe is to set the taper, and then grind the relief. As soon as the cutting edge passes from the plane of the center of the wheel and the reamer axis, which it must do in order to grind the relief, the taper is changed, for the wheel will cut the edge more at the point than at the large end, and the taper will vary according to the amount of rotation given in order to grind the relief. A.—The Morse taper reamers would not be the Morse taper if they were all alike. No. 1 Morse taper is .604″ to the foot; No. 2, .6″ to the foot; No. 3, .601″ to the foot; No. 4, .615″ to the foot; No. 5, .625″ to the foot; No. 6, .634″ to the foot. Full information regarding this will be found in our issues of November 29, 1884, and April 4, 1885. It is usual in grinding taper reamers to fit them to the gauge or receiver before they are backed off, and the machine is then set over to grind the clearance properly without changing the taper. The only bad result from this, then, is that, as the machine is usually arranged, more clearance is given the reamer at the small end than at the large end, because it is rotated more there in keeping the edge on the rest. This is in some cases bothersome, but can be overcome by setting the tooth rest level with the centers, and then blocking up the wheel support to give the desired clearance.

(167) I. S. M., Baltimore, Md., writes: Please answer in your columns the following question, and give method of computation. Having a beam of uniform cross-section 36 feet long, and weighing 15 pounds per foot, with fulcrum 4 feet from the end, how much additional weight will be required to balance it? *A.*—Let *C D* in the accompanying figure be the lever, and *F* the fulcrum,



4 feet from the end *C*. The weight of the lever from *C* to *F* will be $4 \times 15 = 60$ pounds. We must now find the moment of this weight. This moment is numerically equal to the product of the weight into leverage *a*, with which this weight acts. The leverage of a weight uniformly distributed is equal to one-half the distance over which it is distributed, hence, in the case before us the leverage *a* is equal to $\frac{4}{2} = 2$ feet, and the moment of the weight is $60 \times 2 = 120$ foot-pounds. The weight of the lever from *F* to *D* is $32 \times 15 = 480$ pounds. This weight is also uniformly distributed, hence its leverage *b* will be $\frac{32}{2} = 16$ feet, and the moment of this weight will be $480 \times 16 = 7{,}680$ foot-pounds. For equilibrium, the moment on one side of *F* should be equal to the moment on the other side of *F*. But there is a difference of $7{,}680 - 120 = 7{,}560$ foot-pounds between these moments, hence the moment of the weight *C F* must be increased by 7,560 foot-pounds. If the counterbalance is to be equally distributed over *C F*, its leverage will be equal to $a = 2$ feet, and therefore the weight required to balance the lever will be $\frac{7{,}560}{2} = 3{,}780$ pounds equally distributed over *C F*. If the counterbalance is to be suspended from the end *C*, it will act with a leverage of 4 feet, hence a weight of $\frac{7{,}560}{4} = 1{,}890$ pounds suspended from *C* will balance the lever.

(168) T. P. C., Brooklyn, N. Y., writes: Please give the best methods used by machinists and brass workers in setting the slide rest and lathe carriage for turning tapers on the centers, and on work held in the chuck or upon the face-plate. *A.*—An approximation can be made where the work is to be turned on the centers, and the foot-stock center is to be set over, by the following rule: Subtract the smaller diameter of the taper from the larger, divide by 2, and multiply by the ratio which the tapered portion of the work bears to the whole length of the piece. For instance, suppose a shaft 3 feet long is to have a taper on one end 12″ long, the smaller diameter of which is to be 1″, and the larger 1.5″. The difference between these diameters is .5″, which, divided by 2, = .25″. The ratio between the whole length of the shaft and the tapered portion is 3, and .25″ multiplied by 3 gives .75″, or $\frac{3}{4}$″, as the distance to get the center over. This, however, is only an approximation for the reason that the centers enter the work an indeterminate distance, and this modifies the result somewhat, depending upon the proportion between the total length of the work and the depth of the centers. The slide rests, which are graduated, may be set by subtracting the diameter of the small end from the large, dividing by 2, and by the length of the tapered portion of the work measured on the center line. The result being the tangent of the angle to which the rest must be set, which tangent can be found in any table of natural tangents. For instance, suppose the small end of the work is 2″, the large end 6″, and the length measured on the center line 14″. The difference in the diameters of the two ends would be 4″, and half of this (2″) divided by the length, will be .15″, and by a table of natural tangents we find that this corresponds practically to an angle of 8° 30′. The method often pursued, however, is to lay off the taper on paper or a piece of metal, and then set a bevel square to the lines thus found, by which the slide rest is set from the face-plate.

(169) A. D. A., Groton, N. Y., writes: I had an eccentric to make a few weeks ago, to repair our engine. I first bored it out carefully, and as the crank-shaft was too heavy to handle, I made an arbor and laid out the throw on it as I had done many times before. I then finished the eccentric and put it in place, and was surprised to find that the end of the eccentric rod, which was 5 feet long, had $\frac{5}{16}$″ side swing at the end. Thinking my centers were wrong, I made a new set of centers and turned off the eccentric again, but again failed to hit it exactly, and had to conquer the job in another way. Now what I want to know is, how do you make two centers on an arbor whose lines you know to be absolutely parallel? *A.*—The usual method is to place a tool in the tool-post at the proper distance from the center for the throw desired, and without moving this tool draw a circle on each end of the arbor, turning it end for end in the lathe for that purpose. Then lay it on a true surface, and with a surface gauge draw lines at each end radiating from the center, these lines being drawn, of course, without disturbing the position of the arbor upon the plate. The intersection of these lines with the circles previously drawn will then be the points at which the centers are to be drilled, and close work must be done to get it practically exact. After the centers are made, however, slight errors may be corrected by the center scraper, testing the arbor upon the lathe centers with a tool in the post, and applied first at one end and then at the other. Your way of making the eccentric, however, is not the usual or approved one where a single eccentric is to be made. It is usually preferred to lay out the eccentric after facing one side true, and then clamp it to the face-plate to bore and turn, shifting it on the plate for the latter operation. Where many of them are made of the same size it is usual to have a flanged plate in which a stud is fixed, to which stud the eccentric is fastened by a key or set-screws. The stud is then set over the desired amount. 2. Which is the strongest form of thread, a V, a half V, or a square thread, without regard to the pitch or material? *A.*—Of the threads in common use, the Sellers, or Franklin Institute thread, which is the one we suppose you refer to by "half V," is the strongest, all other conditions being equal.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gears, gears, gears, gears, gears. See page 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Ice and Refrigerating Machines, 155 sold, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

Get particulars of our new Wall, Suspended and Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N. Y.

Valve Seat Rotary Planing Machine. Pedrick & Ayer, Philadelphia, Pa.

Cylinder Boring and Facing Machines. Pedrick & Ayer, Philadelphia, Pa.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

I. D. L. Drawing Stands. The original. For particulars and prices, address W. S. Rogers, Troy, N. Y.

Castings for small and medium-sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

To get the best work out of a Star Hack Saw, bear down heavily, and draw it very slowly.

S. A. Smith, 23 So. Canal st., Chicago, Ill., agent for Appleton Mfg. Co.'s Emery Grinding Machinery.

Audubon Machine Works, New Haven, Conn. Electrical work, superior facilities, builders of machinery, heavy and light.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For the latest improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dill Machine Company, Philadelphia, Pa.

Self-adjusting Hand-screw for pattern makers, cabinet makers and wood workers generally; send for circular. Wm. H. Denney, Lancaster, Pa.

"Twenty Years With the Indicator," by Thos. Pray, Jr., 9,500 sold. Price $2.50. Order of bookseller, take no other.

25″ 32″ 37″ 42″ — "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

DuBois & DuBois, Patent Attys, 715 11th St., Washington, D. C., procure first-class patents. Send stamp for illustrated pamphlet, "March of Invention," containing valuable information, and list of references.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

Foot and Power Presses for Metal, Paper and Leather; perforating dies a specialty; estimates given for special Machines or Dies. Edwin B. Stimpson & Son, Manufacturers, 31 Spruce st., New York.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt St., New York

Hawkins' Calculations for engineers, steam users and machinists are issued in 10 parts, 25 cents each (bound, for $2.50). "The only books I ever received that you could start from bottom of ladder and climb up." Geo. E. Welkish, Mendota, Ill. Theo. Audel & Co., pubs., 91 Liberty st., N. Y. Catalogue.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th St., New York.

MANUFACTURES.

G. W. Taylor will erect a saw-mill at Astor Park, Fla.

R. O. Pate will establish a saw-mill at Hawkinsville, Ga.

R. R. Scott, Titusville, Fla., will build a saw and planing-mill.

A $40,000 electric light plant is to be erected at Key West, Fla.

E. H. Mason, of Atlanta, Ga., will establish a machine shop in Madison, Ga.

Authur & Lipscomb will erect a wood-working factory at Bryson City, N. C.

The Altamaha Cypress Lumber Company will erect saw-mills, etc., at Brunswick, Ga.

The Red River Lumber Company, New Lewisville, Ark., is building a saw and planing-mill.

It is stated that W. O. Ware & Son will establish a planing-mill at King's Mountain, N. C.

An English company is to establish a mill at Shelby, Ohio, to make tubes for bicycles.

It is reported that the Fort Payne Coal and Iron Company will erect an electric light plant.

The Atlanta Lumber Company, Atlanta, Ga., will build a planing-mill and sash, door and blind factory.

The National Wire and Iron Company, Cleveland, O., has been incorporated, with a capital of $10,000.

C. F. Kane, of Martin's Ferry, Ohio, has established a branch machine shop in Mannington, W. Va.

A. C. Summerville and others are organizing a stock company to erect a cotton factory at Gastonia, N. C.

The Superior Furnace Company, at Little Falls, N. Y., has just added a 60x100 foot foundry to its works.

The Star Knitting Works, at Chicago, have filed a certificate of increase of capital stock from $10,000 to $20,000.

The Buffalo Lock Manufacturing Company has broken ground for their new factory at East Richmond, Va.

The Little Rock Handle Factory, Little Rock, Ark., has recently reorganized and put its plant in operation.

It is stated that Lacey & Young, of Jefferson, Texas, have erected a saw mill, and will build a planing-mill.

A $25,000 stock company will, it is stated, be organized at Macon, Ga., to erect an agricultural implement factory.

W. E. Peregoy & Co., of Baltimore, Md., contemplate the erection of a saw and planing-mill in North Carolina.

P. Moriarity & Co., Ashland, Ky., will incorporate, with a capital stock of $50,000, to conduct a planing-mill business.

The Howard-Harrison Iron Company, at Bessemer-Ala., commenced work on the 18th ult. They will employ 1,000 men.

H. A. Johnson & Co., Chattanooga, Tenn., will put in new machinery, and enlarge their saw-mill, at a cost of $15,000.

The Huntington & Big Sandy Railroad Co. is reported as to erect machine shops and roundhouse at Huntington, W. Va.

The De Bardeleben Coal and Iron Company, of Bessemer, is opening new iron mines in Red Mountain, near Powderly, Ala.

A stock company is, it is stated, being organized, to build and operate a cotton mill and other manufactories at Canton, Ga.

It is stated that a committee will endeavor to organize a $60,000 stock company to erect a rolling-mill at San Antonio, Tex.

It is reported that the Rome (Ga.) Iron Company will convert its new charcoal iron furnace into a ferro-manganese furnace.

The Hammond Mfg. Company, of Archdale, is considering the removal of its sash, door and blind factory to Asheville, N. C.

It is stated the Magnetic Machine Manufacturing Company, of Grand Rapids, Mich., will remove its motor works to Basic City, Va.

McClure, Grenamyer & Co. will establish a sash, door and blind factory in connection with their lumber-mill, at Fayetteville, N. C.

The stockholders of the Malleable Iron Company, at Chattanooga, Tenn., have authorized the directors to add a steel plant to the works.

J. W. Castles, W. S. Wilkerson and others will at once endeavor to organize a stock company to erect a cotton-mill at Hickory Grove, S. C.

A company has been formed at Gager, Wash., to erect another saw-mill at that point. The company will put in a lumber yard at Whatcom.

C. H. Rose has contracted with the Grottoes Company to erect a factory for the manufacture of goods in brass and iron, at Shendun, Va.

F. X. Ohlen and C. C. Chaffee, of Columbus, Ohio, have, it is stated, made arrangements for the establishment of saw works in Atlanta, Ga.

It is stated that the Lattimore Machine Company, St. Louis, Mo., will build a new factory on East Elwood street, on land donated by the city.

The Standard Planing-mill and Building Company has been organized at Ashland, Ky., and will build a planing-mill. Capital stock, $100,000.

The Richmond Brewing Company will build a large brewery at Richmond, Va. It will be five stories high, with all modern improvements.

It is stated that William Huttig, of Muscatine, Iowa, is considering the feasibility of putting in a large sash and door factory at Salt Lake City.

Negotiations are pending between the Middlesborough, Ky., Town Co. and Cincinnati, O., parties for the erection of a cotton-mill at Middlesborough.

The El Paso (Tex.) Foundry and Machine Company, operating an iron foundry and machine shops, has been incorporated, with a capital stock of $50,000.

Fay & Scott, Dexter, Maine, are extremely busy on machine tools and general machinery, having so many orders that their capacity to fill them is taxed to the utmost.

Camden, S. C., is to have a new cotton-mill. The capital stock of the company pushing this enterprise is to be $130,000, with the privilege of increasing to $150,000.

E. L. Hawkes, of Winston, and J. H. Barnard, of Asheville, are reported as to erect an electric power plant in Wilmington, N. C., to operate the street railway.

New additional furnaces are being erected by the Collinsville (Ill.) Zinc Works, which, when completed, will increase the output from 20,000 to 30,000 pounds per day.

Fire has destroyed the foundry department of the Poorman Iron Works, Canton, O., where some valuable patterns were stored. The loss is several thousand dollars.

Richmond capitalists have, it is stated, purchased property at Mount Athos, Va., and will erect an iron furnace. J. B. Robertson, of Lynchburg, can give information.

The Bogenschutz Stove and Range Company has been incorporated, at Covington, Ky., to manufacture stoves, hollow ware and castings. The capital is said to be $100,000.

The Washington and Georgetown Railroad Co., Washington, D. C., is replacing horse-power by cable traction. Ground has been broken for a plant to cost $400,000.

It is stated that plans have been prepared and machinery ordered for a cotton-tie factory to be erected at Cardiff, N. C. The Cardiff Coal and Iron Company can give information.

There is water works agitation in Englewood, N. J.; Front Royal, Va.; Hickman, Ky.; Lima, Ohio; Woonsocket, Mass.; Niles, Ohio; New Castle, Pa.; Tacoma, Wash.; Duluth, Minn.

The Gorrell Manufacturing Company, at Bel Air, Md., has been incorporated, for the purpose of developing a pending patent of C. L. Gorrell for a machine for labeling tin cans.

The Danville Foundry and Machine Company, of Danville, Ill., has been incorporated, with a capital stock of $75,000, and these incorporators: W. M. Stewart, Mary Stewart and L. A. Chesley.

It is stated that B. J. Soper, of Malone, N. Y., has purchased a controlling interest in the Elliott Car Works, located at Gadsden, Ala., and that $100,000 will be expended in improving and enlarging same.

The Elgin Rand Saw Company, Elgin, Ill., has been incorporated, with a capital of $50,000. The company will manufacture saw blades. The incorporators are Sedgwick G. Duell and F. H. Gillette.

It is proposed to organize a $100,000 stock company, to establish boiler and engine works at Big Stone Gap, Va. It is stated that Bonnot Bros., of Louisville, Ohio, offer to take $60,000 of the amount.

L. H. Wilson, J. M. Raney, W. W. Worcester and others have incorporated the Worcester Wire Manufacturing Company, for the purpose of manufacturing wire goods, at Newport, Ky. The capital stock is $12,000.

The Cleveland Co-operative Stove Company's plant at Springfield, Mo., is completed, and materials are arriving there daily, with which to begin operations. The works will soon start up with some thirty molders.

It is stated that arrangements have been made for the establishment of an agricultural implement factory at Martinsburg, W. Va. The Martinsburg-Miami Manufacturing and Improvement Company can give information.

The Toronto Drop Forge Company, Toronto, Canada, is being incorporated, with a capital stock of $40,000, to manufacture iron, steel and copper forgings, architectural and other iron work. Head office, West Toronto Junction.

The Wheeler & Tappan Company has been incorporated at Chicago, to manufacture and deal in steam pumps, machinery and appliances; capital stock, $150,000. Incorporators: Thomas J. Wheeler, Amos K. Tappan and F. J. Griffen.

Articles of incorporation have been filed by the Northwestern Engineering and Machinery Company, of St. Paul, Minn. The capital stock is $50,000, and the incorporators are Charles A. Daigh, W. G. Strickland and J. M. Badger.

The nail factory of the Riverside Iron Works, of Wheeling, W. Va., has started up again, after standing idle since the February flood, when the waters caused considerable damage, inclusive of the soaking of about 4,000 kegs of nails.

A company has been organized and will incorporate, with J. B. Beal as president; Miles Hanna, vice-president, and J. R. Spencer, secretary, to establish iron foundry and machine shops at Gastonia, N. C.; capital stock to be $25,000.

The Canonsburg Iron and Steel Company, of Canonsburg, Pa., has decided to enlarge its capacity. The firm manufactures sheet iron and steel for stamping purposes and galvanizing. The present capacity is about 4,000 tons per year.

The Madison Car Company's new buildings, at Madison, Ill., are being rapidly pushed to completion. The company are laying in heavy stocks of lumber, iron, etc., with which to begin work as soon as possible on contracts already in hand.

Edward Holder, J. W. Strehli and J. J. Mulvaney, Jr., have incorporated the Queen City Barrel Header Company, at Covington, Ky., to manufacture machines for heading barrels, casks, etc., and all kinds of special coopers' machinery; capital stock, $300,000.

The Keystone Manufacturing Company have filed application for a charter in Pittsburgh, Pa., The company propose to manufacture iron and steel products. The stockholders are T. H. Adams, C. E. Dickson, Grant McCargo, J. M. Craig and S. M. Willock.

The Frontier Iron and Brass Works, Detroit, Mich., have issued a catalogue of pulverizing, granulating, drying and separating machinery and apparatus, of which they build a variety. They also build simple and compound condensing and non-condensing engines.

The Fossil Meal Company, No. 2 Cedar street, New York, has just finished covering the boilers and steam pipes of the P. R. R. ferryboat "John S. Darcy." This makes 25 boats for this company, of which the boilers and pipes have been covered by the Fossil Meal Company.

The A. W. Cadman Manufacturing Company has filed application for a charter in Pittsburgh, Pa., the purpose of the company being the manufacture of iron and steel. The stockholders are A. W. Cadman, A. M. Patton, W. J. McDermott, J. G. Taylor and Frank G. Lenz.

The Martinsburg Mining, Manufacturing and Improvement Company has closed a contract with the Common Sense Engine Company, of Springfield, Ohio, to build branch boiler and engine works in Martinsburg, W. Va. The company expects to be ready for operation by July 1st.

The town council of Brilliant, Ohio, have given to the Brilliant Iron and Steel Company of that place, a part of a street asked for by the company, who bound themselves to build additions to the mill, and increase its working capacity by forty or fifty hands, as a condition of the grant.

The D. Frisbie Company, 112 Liberty street, New York, has issued a catalogue and price list of friction clutch pulleys, countershafts with friction clutch pulleys, cut-off couplings, etc. The catalogue is illustrated, and contains descriptive matter and directions for fitting and adjusting.

The Taylor Electric Signal Company, of Chicago, has been organized; capital stock, $500,000. The company intends to manufacture electrical and mechanical devices, and machinery for steam and street railways; incorporators, C. H. Merrill, Frederick L. Merrill and George W. Heth.

The Jos. Dixon Crucible Company, Jersey City, N. J., issues a catalogue of American graphite pencils, in which they give a description and prices of pencils for artists, draftsmen and others. This company makes about 500 different styles of pencils, suited to a great variety of purposes.

The Lone Star Iron Company's iron furnace, at Jefferson, Texas, has been put into blast. The company has decided, it is stated, to build a $1,000,000 steel plant to be operated in connection with its furnace, and appointed a committee to solicit stock; this will necessitate the construction of additional furnaces.

The Garvin Machine Company, New York, have issued an 1891 catalogue of machinery and machinists' tools. It contains illustrations, descriptions and prices of a large variety of machine tools and other machines, and, besides, gives general information, tables, etc., on several subjects of interest to mechanics.

The Damascus Steel Company, of Portsmouth, O., has decided to locate works in Denver, Colo., a new organization having been formed between the company and several capitalists of the latter city. This company manufactures steel tools. Its new works will cost in the neighborhood of $250,000, and will employ several hundred men.

The Essex Brass and Iron Company, of London, Ont., has been incorporated, with a capital stock of $30,000, for the purpose of carrying on a general brass and iron foundry business, including the manufacture of all kinds of brass, iron and other metal goods, electrical and other machines and appliances.—*The Canadian Manufacturer.*

The Adams Direct Process Steel Company has been organized, for the purpose of manufacturing steel in Virginia by the Adams process. J. D. Weeks, of Buchanan, is president; E. C. Pechin, of Roanoke, is vice-president; and J. C. Schultz, of Buchanan, is secretary. This company has the exclusive right to the Adams process in Virginia.

The Adams Laundry Machine Company, organized to make laundry and other machinery, at Troy, N. Y., has been incorporated, with a capital of $30,000, divided into 300 shares. The operations are to be carried on in Troy, and the trustees for the first year are: Alonzo Sharp, John Ballie, Jr., Barclay Thomas, James W. Hislop and Arthur G. Gray.

The Oil Well Supply Company has filed application for charter in Pittsburgh, Pa. The stockholders are John Eaton, of Pittsburgh; E. H. Cole, Brooklyn, N. Y.; E. G. Burnham, Bridgeport, Conn.; Ezra T. Homes, Olean, N. Y., Kenton Chickering, Oil City, Pa., and Kenton Saulnier, Bradford, Pa. The object of the company is the manufacture of iron and steel products.

It is stated that the Newport Development Company has secured the following industries for location in Newport, N. C. An electric light plant, and a sash, door and blind factory, to be erected by North Adams (Mass.) capitalists, and brick works; also that the company is now negotiating for a 50-loom woolen-mill, a 4,000-spindle cotton-mill, and a foundry and machine shop.

The Mason Regulator Company, Boston, Mass., send us an Easter egg in a neatly prepared box, which also contains a card, and an invitation to break the egg. Doing so reveals the fact that the original contents have been abstracted, and in their place, printed on tissue paper, along with other matter, is mention of reducing valves, air-brake regulators, and damper regulators made by this company.

The Buda Foundry and Manufacturing Company is now placing the machine tools, etc., in its new shops at Harvey, Ill. These shops are very extensive, and will enable the company to increase its output so as to fill all orders without delay. This concern has been very successful in the past, and, with the additional advantages which the new location gives, it should have a still more prosperous future.

Mr. James Hall, representing the New York Sewing Machine and Manufacturing Company, of Richmond, Va., will be in the city on Tuesday to select a site and break ground for their new factory in East Richmond, plans for which are complete. Mr. Hall will be accompanied by Mr. J. C. Green, of Williamsport, Pa., and other capitalists, who will take a large interest in the East Richmond enterprise.—*The Richmond* (Va.) *Dispatch.*

M. M. Holtner and other Montana capitalists propose, for a bonus of $50,000, to build and operate a saw-mill, with a capacity of 100,000 feet a day, at Astoria, Oregon. Negotiations have been partly closed, the terms being: Mr. Holtner, as an evidence of good faith, puts up $5,000 as security, and if the committee of the board of trade raise the bonus required he will build and operate the mill. Should the bonus be raised and the mill not built, the $5,000 is to be forfeited to the board of trade.

The American Automatic Sliding Railway Company, of Chicago, has been incorporated. The promoters intend to demonstrate the principle of hydraulic pressure for the propulsion of cars and other vehicles for the transportation of passengers and freight, and to manufacture, equip and operate the necessary motors, machinery appliances, rails, cars, devices and equipment therefor. Jules Juvenot, Jules Rigonlat, Emile P. Voisard, L. Compondu and Auguste Waldejo are the directors of the company.

The Eureka Tempered Copper Company, North East, Pa., inform us that they are to receive from the Franklin Institute the John Scott medal premium and award for "tempered copper" for bearings. This copper is used very extensively for bearings, especially around electric lighting machinery, and for a great variety of purposes where strength and superior wearing qualities are requisites. The company issue a little catalogue in which some of its uses and qualities are enumerated, and numerous testimonials given.

The Lunkenheimer Brass Manufacturing Company, Cincinnati, O., announces that it has bought the entire plant and good will of the Porteous Brass Manufacturing Company of that city, and has removed the machinery and tools of the latter to the new addition to its own works at 11 and 13 East Eighth street. This purchase largely increases the capacity of the Lunkenheimer works for producing its specialties in valves, lubricators, oil cups and grease cups, and also its general lines of engine builders' and steam fitters' brass work.

The Chicago Malleable Iron Company, the Cleveland Malleable Iron Company, the Indianapolis Malleable Iron Company, and the Toledo Malleable Iron Company, have been consolidated. The new company is known as the National Malleable Castings Company. The officers of this company are A. A. Pope, president; E. L. Whittemore, vice-president; O. K. Brooks, secretary and treasurer. The change is in one sense nominal, for the business of the various companies will be conducted on the same lines and practically under the same management as before.

Mechanical Skill and Wages.

The *Manufacturers' Gazette* precedes some editorial advice to mechanics by the following words: "The only object which any man can have in becoming skillful at his trade, excelling in his ability to produce, is that he will be able to demand a higher price for his labor." Now, if our contemporary has never discovered any other incentive that stimulates men to excel in mechanical trades besides this, then it seems to us that it must have very little acquaintance with mechanics, or must be remarkably unobserving.

As the result of a somewhat extended acquaintance with mechanics in this country, we are prepared to say that they not only can have other objects in self-development, but that most of them do have, and that a large majority—indeed, nearly all of the best mechanics, take an interest in their business, study it, and strive to excel in it, with very little regard for or thought of the increased compensation to be obtained thereby.

Our contemporary ought to know that mechanics are just the same as other people in most of the characteristics of human nature, and that they are actuated by the same desire to possess knowledge for its own sake, and to excel in anything which they may undertake for the sake of excelling, and because there is a gratifying pleasure in it, while there is mortification in being left behind, or in the acknowledgment of inferiority. It is this spirit of emulation which is at the bottom of most of the world's progress in any direction, and mechanics have their full share of it.

We do not mean to say that money is despised by them, nor that it should be; but we know that it is nearly always a secondary consideration with the best and most ambitious mechanics, and that increased wages in compensation for superior skill or knowledge are seldom thought of until after the skill and knowledge have been acquired for other reasons.

The few men who do nothing, and have no ambition to do anything, except for what it brings in money, are not found in the ranks of the best mechanics, for several reasons; one of which is that such men cannot become good mechanics, and another, that men whose sole ambition it is to make money can usually find other ways of making it, which bring greater returns.

We can assure our contemporary that if there were no other incentive to the acquirement of mechanical skill besides increase of wages, there would be precious little of it acquired, though, after it is acquired, mechanics do not, of course, object to receiving the highest obtainable compensation for it.

Composition Condensers for the U. S. Cruiser "Maine."

Two composition surface condensers for the U. S. cruiser "Maine" have been recently completed for N. F. Palmer, Jr., & Co., New York, by the South Brooklyn Steam Engine Works, Brooklyn, N. Y. These works are fitted up and have all the modern facilities for building surface condensers of every description and size; in fact, this class of work is one of their specialties. The following are the dimensions of the condensers which are for the cruiser "Maine":

Length over all, 11 feet 6 inches; height, 9 feet 6 inches; diameter of shell outside of flanges, 6 feet 11 inches; inside diameter, 6 feet 6 inches; thickness of metal, $\frac{7}{16}$ inch; number of tubes in each condenser, 5,141; cooling surface, 7,010 square feet; weight of each condenser, 21,600 pounds; weight per square foot of surface, 3.08 pounds. The holes in the heads for the tubes were cast somewhat smaller in diameter than that of the tubes, and then bored out to correct dimensions. The manner of packing the tubes is shown in the accompanying illustration. The tubes extend through the heads, or nearly so, then ordinary round corset lace is wound around the ends, and forced against the tubes by means of brass glands screwed into the head. The hole through the gland at the outer end is made conical, so as to reduce the diameter in that end to a smaller size than that of the tube. This form of gland allows sufficient expansion for the tube, and at the same time prevents it from moving out of position.

These condensers were subjected to two hydrostatic tests of 30 pounds to the square inch; in one case the pressure of the water was applied to the outside of the tubes, and in the other, to the inside. This test pressure is unusually high, but these condensers stood the test well, and gave every evidence of good workmanship.

The South Brooklyn Steam Engine Works have been quite busy during the past two years on government work, and have at present in the course of construction one condenser for the U. S. cruiser No. 5; one for cruiser No. 6, and two for cruiser No. 11. All these will be made of composition throughout. They are also building a number of condensers for other parties. The shells of some of these condensers are made of cast-iron, but this increases the weight from 9 to 11 pounds per square foot of cooling surface, which in some cases is objectionable, and therefore, in order to reduce the weight, brass is often preferred. For the mercantile marine service, the holes in the condenser heads for the tubes are often cast to the correct size, either in cast-iron or brass heads, and they require no finishing. With the facilities provided for making castings of this kind, this firm is enabled to cast these holes with surprising accuracy and smoothness.

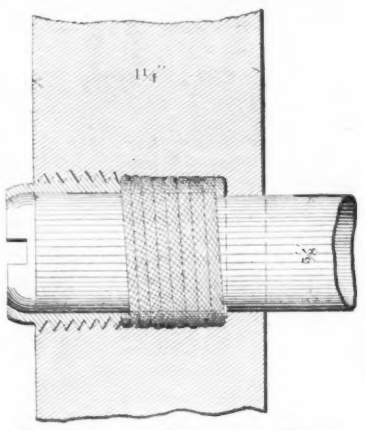
Sweeping Conical Winding Drums.

BY P. S. DINGEY.

It may not be understood by some why a winding drum is sometimes made conical instead of a straight cylindrical form, and it may not be entirely out of place here to explain the reason, for the benefit of such.

Conical drums are used for winding heavy loads from deep mines. When the skip or load is at the bottom of the mine, ready to be hauled up, the winding on the drum begins at the small end, and as the rope does not wind as fast on the small end as it does on the large end of drum, it allows the slack rope in the shaft to be gradually taken up at the starting, and also prevents the load from starting too suddenly. The engines also gain a decided advantage when winding with conical drums, because, instead of the winding being started at full speed, it gradually increases, thus giving the engines a better chance to do their work.

It is scarcely necessary to inform the readers of the AMERICAN MACHINIST that it requires a great deal more skill to build and



PACKING FOR CONDENSER TUBES.

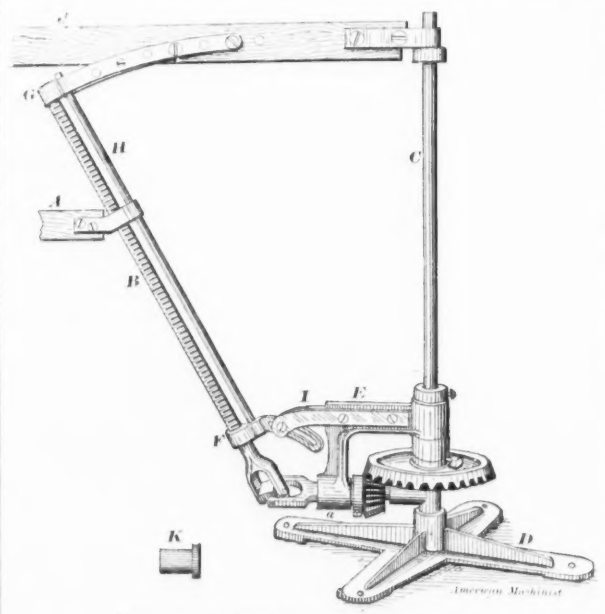
properly secure a mold for a large conical drum than it does to mold a grate bar; but there is a class that stands so high in the engineering profession, that to them all foundry work is just a little above unskilled labor — something requiring more brute force than anything else. Such ideas, though, do not prevail among our genuine and practical engineers; they are only found among the cleverly ignorant.

All those who have had much to do with the machinery business know what an amount of consultation and scheming is necessary before some jobs in a foundry can be started, and then how it requires men of good sound judgment to execute the work.

The building of a mold for a large conical drum is one of these jobs. The way of sweeping the groove, an arrangement for which I propose to describe, is only a small item of the work.

A is the sweep that travels up and down the screw *B* as it is pulled around. The spindle *C* is secured to the cross *D* at the bottom; the bevel gear is fast on the spindle, two set-screws in the hub holding it in place; the bracket *E* is loose, and turns on the spindle; it has a bearing at *a*, in which the pinion shaft runs; the end of this shaft is carried by a tee piece that turns on the spindle. The pinion shaft and the screw are connected by a universal joint, while the screw is carried by two adjustable curved pieces *F* and *G*. Guide rod *H* keeps the nut from turning on screw *B*; arm *I* fits over the bracket *E*, and carries the curved piece *F*; this arm is also adjustable.

Now it will be clearly seen that, if the arm *J* and the bracket *E* are pulled around, it will cause the pinion and the screw *B* to



SWEEPING CONICAL WINDING DRUM.

turn, thus making the sweep *A* to travel a certain distance every time it goes around. The gears determine the pitch of the groove to be swept; if the proportion of the gears are three to one, and the screw $\frac{1}{2}$" pitch, then the sweep will travel $1\frac{1}{2}$" at every turn, making a groove $1\frac{1}{2}$" pitch. When any other pitch is required, the gears must be changed for those of a different proportion, for instance, for a 2" pitch drum, the proportion of the gears would be 4 to 1. Bracket *E* is made so as to permit the use of gears of different sizes.

When a drum is wanted with a left-hand groove, the gear on the spindle is turned upside down, and located under the pinion instead of over it. The machine is also arranged so that a drum of any angle can be swept. This is done by loosening the bolt that holds part *F* in place, and by taking out those in the upper part *G*, thus allowing the screw to be swung at any angle from the center of the universal joint.

The reason for making the arm *I* separate from the bracket *E* is obvious; it is to give a better chance for adjusting the lower part of the machine than the swinging of the screw gives. The pinion shaft runs in close to the upright spindle, so that when the set-screw in the pinion is loosened, the shaft can be pulled out to the required distance, and the set-screw in pinion be tightened again. When this is done, it will be found necessary to bolt on the flanged sleeve *K* to the end of bracket *E*, between the universal joint and the bearing *a*. For building and sweeping up the mold roughly, the screw and pinion shaft can be disconnected entirely and a plain sweep made, bolting it to the upper and lower arms *J* and *I*.

The engraving only represents the model of this machine; the details of the machine proper will vary somewhat. For instance, where there are solid boxes on the bracket *E*, for the spindle and pinion shaft, there should be caps, so as to make it easier to disconnect the parts. The universal joint should also be made separate from the screw and pinion shaft; many other items would need changing when building a machine to do the work.

Once in a while a daily paper gets an idea so fairly mechanical that it is worthy of extra publicity. The following from the *Commercial Advertiser* is a case in point:

Finding that the class of men most desirable for duty in the engineer's force of the navy is not forthcoming through the regular channels of enlisting, the navy department has at last decided to fall in line with the repeated recommendations of the chief of the bureau of steam engineering, and start a practical school of instruction for recruits aboard the monitor "Miantonomah," now about ready for going into commission. It is quite noticeable that on the trial trips of the new cruisers there is not only selected coal, but the firemen are also picked, and, in some cases, receive an extra bonus if the trial is successful. Just when to throw coal into the furnaces and just where to throw it is knowledge only gained by experience. Economy demands that the men-of-war do the greater portion of their cruising with only a portion of their boilers in use, so that but little additional experience is gained in the matter of forced draught, high steam pressure and coal consumption. It is unfortunate that no other vessel than the one mentioned is available, but it is a beginning, and a marked departure from former methods. It is easy to figure upon the possible horse-power per square foot of grate surface, but it must be remembered that the fireman is a most important factor, and if he is unskilled the most careful calculations will be in vain. It is high time to do away with the old-fashioned notion that putting a man down in the fire room, with a shovel in his hand, makes him an expert fireman.

During last month there was launched from the yards of the Chicago Shipbuilding Company, Marina, which is said to be the first steel steamer built on the shores of Lake Michigan. She was built to the order of the Minnesota Steamship Company. Her dimensions are 308 feet over all, 292 feet keel, 40 feet beam, and 24 feet 6 inches molded depth. The engines are of the triple-expansion type, and were built by the Globe Iron Works Company, Cleveland, Ohio.

The steam yacht Nydia, designed by Henry I. Gielow, 239 Broadway, New York, and illustrated in our issue of June 5, 1890, was recently caught in a storm off the coast of South Carolina, said to have been one of the severest gales experienced on that coast for years. The yacht proved to be very seaworthy in every respect, and pulled through without the slightest damage.

Our item of last week, mentioning the newly formed connection of Mr. George F. Badger with the firm of John Maslin & Sons, should have been to the effect that Mr. Badger has made arrangements to represent that firm's line of steam vacuum pumps. His address will hereafter be 165 and 167 First street, Jersey City, N. J.

It is said that an expedition is to sail from Melbourne in July next, for the exploration of the icy region surrounding the south pole.

Machinists' Supplies and Iron.

NEW YORK, April 4, 1891.

Iron—American Pig—The market is quiet and steady, the prices remaining about the same as in our last week's report.

We quote No. 1 Foundry, Standard Northern brands, $17 to $18; No. 2, $15.75 to $17; Southern brands No. 1 Foundry, $16 to $17.50; No. 2, $15.25 to $16; and No. 3, $14 to $14.50.

Scotch Pig—We quote Coltness, $24.50; Dalmellington, $22; and Eglinton, $20.50.

Copper—The market is unsettled. All sorts of talk is heard on the streets to influence prices, although supplies of Lake Copper have been offered on the Metal Exchange at 13.80c., without buyers. The regular quotation remains at 14c. Casting copper continues in fair request, and quoted firm at 11½c. to 11¾c., in a large way.

Lead—Actual business is light, but the firm feeling has caused more inquiry; 4.30c. has been offered for large quantities on spot and near by, while holders demand 4.35c. to 4.40c.

Spelter—Smelters are reported firm in their views, and quote 5.10c. for New York shipments, while spot lots are held at 5.15c. to 5.20c.

Tin—Business is light, prices are higher, and offerings more reserved. For spot delivery 20.30c. is bid, and 20.40c. is asked.

Antimony—The market is steady and dull.

We quote Hallett's, 16c. to 16½c.; Cookson's, 17½c. to 18c.; and L. X., 16½c.

Lard Oil—The market is barely steady at the former figure of 55c., but it is claimed that 53c. would buy a round lot of prime.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Agents for the Blake damper regulator. See advertisement, page 19.

Wanted—Position by first-class mech'l draftsman, capable of taking charge. Reliable, AM. MACHINIST.

Wanted—Pattern makers; 3 or 4 at once. Apply to The Pond Machine Tool Co., Plainfield, N. J.

Mechanical draftsman with practical shop experience wants position in New York. N., AM. MACH

Wanted—A few first-class machinists for engine work on tools and erecting floor. The Ball Engine Company, Erie, Pa.

Wanted—Position as foreman or supt., by man thoroughly familiar with drawing sheet metals, and general machine and tool work. A. B. C., AM. MACH.

Wanted—To correspond with capable machinists accustomed to fitting up lathes. Address W. S., care of AMERICAN MACHINIST.

Wanted—A position as supt. or foreman of boiler shop; long experience, temperate, best of reference. S. G. Orghard, 227 St. Louis avenue, Chicago, Ill.

Foreman of machine shop wishes change of position; screw machine or general work preferred. A1 reference. Address Change, AMERICAN MACHINIST.

Wanted—Situation as first-class pattern maker, small hard wood, steel and malleable workers preferred. Address Pattern Maker, Katonah, N. Y.

Wanted—First-class boiler maker to take half interest in shop in small town. Substantial and growing business guaranteed. Wm. Bartley & Sons, Bartley, N. J.

Wanted—Foreman for brass finishing department on valves, cocks and specialties; must have executive ability, and be familiar with modern tools. Address, stating salary req'd, Box 75, AM. MACHINIST.

Boiler Makers Wanted—Good wages and steady work to steady, reliable men who apply at once. Merrill-Stevens Engineering Co., 138 and 140 E. Bay st., Jacksonville, Fla.

Wanted—Good machinists who understand building and erecting looms and other weaving machinery; steady employment. Address Schaum & Uhlinger, Philadelphia.

Wanted—Job by fairly good general machinist in repair and job shop; marine preferred; chance to improve; wages no object. Address W. F. M., AMERICAN MACHINIST.

Wanted—Position as draftsman; 11 years experience, 3 years in this country. High-school graduate, A 1 reference. Specialty, ordinary and special machine tools. Address J. H. B., AM. MACH.

Wanted—By a young man, 26, married, a position as draftsman. Specialty, turret machinery. Is a practical machine photographer. Southern N. E. or Eastern N. Y. preferred. Address Turret, AM. MACH.

Wanted—A prac. machinist, pattern maker and draftsman, 19 years' experience as foreman building engines and job work, would like similar position; best reference. Address H., AMERICAN MACHINIST.

Wanted—A man who thoroughly understands repair work on small, intricate and fine machinery; must be sober and well recommended; steady employment can be given such a man. Address, stating wages wanted, The Ames Bonner Co., Toledo, O.

Wanted—An active man as foreman or supt.; one up in modern machine shop practice, and handling men; must understand engine construction; one having experience in pumping machinery preferred; state age, experience, and salary expected. Address Box 73, AM. MACHINIST.

Wanted—A first-class tool designer and maker to take charge of the designing and making of tools for small work; will have charge of thirty tool makers; steady employment and good salary to a strictly first class man; no other but one of experience in small and close work need apply. Address National Cash Register Co., Dayton, Ohio.

Wanted—Foreman of engine department; young man not over thirty-five, who has had experience in handling men, and is a thorough mechanic. State experience, naming references and salary wanted. Buffalo Forge Co., Buffalo, N. Y.

Wanted—A first-class mechanic having $5,000 to engage with an established concern in the manufacture of machine tools in the best machine tool center in the West. Have orders for three months ahead, and can secure order at once for $30,000 in addition. Only first-class man with executive ability, having had experience in manufacturing high grade machine tools, need apply. Address Business, American Machinist.

Wanted—A thoroughly competent foreman for a machine shop in Onfario, Canada, in a live railway town, making mowers, reapers, binders, horse rakes and plows. From 60 to 80 hands in that department. None but experienced men, accustomed to agricultural implement work, need apply. Must be quick at figures, and understand all the latest methods of doing work cheaply and to advantage. State age, and salary expected. Apply to Box 78, American Machinist.

Wanted—One or more parties to purchase with the advertiser a desirable part of the manufacturing business of an old-established concern, who has not the room or facilities to continue it. An opportunity is here offered for a profitable investment, the purchasers to take an active part in the management or not, as may be arranged. Location, a flourishing city of 135,000 people in New York State. Address Enterprise, American Machinist.

Sales Agent Wanted—For water tube boilers and general machinery, with headquarters at our main office, a mechanical engineer preferred, with capacity for eventually looking after outside business, and ability to design and direct the construction of complete steam plants; all communications must be by mail, and will be held strictly confidential; interviews arranged later on. Address, stating salary expected, and give references, National Water Tube Boiler Co., New Brunswick, N. J.

Wanted—A young man of shop and drafting-room experience in wood-working machinery, for two months, to work up designs and drawings for a special patented planer and matcher. Address P. & M., American Machinist.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Just out: aluminum steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Screw-cutting lathes, 18 in. and 26 in. swing, $85 and $165. Address B. J., American Machinist.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

For Sale—Yale & Towne hand traveling crane, 4,000 pounds, 18 feet span, in first-class order, with Harrington hoist, very little used, and a bargain. Samuel C. Tatum & Co., 264 Water street, Cincinnati, O.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa

For Sale—At a bargain, well-established machine shop in South Jersey doing a good business on new work and general repairs. Sold only on account of ill health. Address Box 77, American Machinist.

"TIME IS MONEY."

"The smith his iron measures
Hammered to the anvil's chime."—Longfellow.

"And his **BRADLEY HAMMER** treasures,
Since it saves him work and time."—Some-other-fellow.

2000 IN USE. PLEASE INVESTIGATE.

BRADLEY & CO., SYRACUSE, N. Y.
14 Warren St., New York. 96 & 98 Sudbury St., Boston.

PLANER VISES.
THE GILKERSON MACHINE CO.,
HOMER, N. Y.

STEEL TUBES
WELDLESS
SMOOTH · COLD DRAWN
John S. Leng's Son & Co. New York.

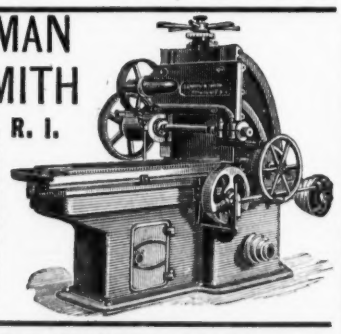
BOOKS ON BOILERS.

Thurston's Manual of Steam Boilers.—Profusely illustrated. 8vo, cloth, **$5.00.**

Thurston's Engine and Boiler Trials.—With illustrations. 8vo, cloth, - **$5.00.**

Mailed and prepaid on receipt of price.
JOHN WILEY & SONS, NEW YORK.

BEAMAN & SMITH
PROV. R. I.



EUREKA TEMPERED COPPER CO.
NORTH EAST, PA.
MANUFACTURERS OF
WILSON'S EUREKA BABBITT.
THE BEST ANTI-FRICTION METAL EVER OFFERED TO THE TRADE.
Satisfaction Guaranteed in Every Case.

FOR RENT.

In the best Natural Gas City in Indiana, Buildings with heat, light and power, equipped with automatic sprinklers, steam heat and electric light suitable for light or heavy manufacturing.

Address JAS. BOYCE, Muncie, Ind.

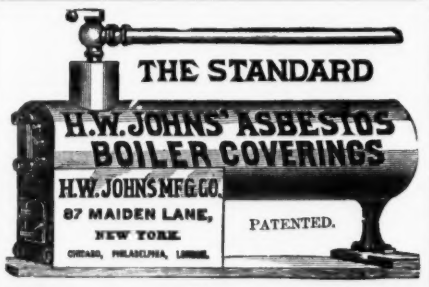
FOR SALE.

The following new boilers were in our shop at the time of our fire, and will be offered cheap to close out:

Two	12 H.P.	Vertical	Boilers.
One	10 "	Locomotive	"
Two	15 "	"	"
One	25 "	"	"
One	35 "	"	"
One	40 "	"	"
One	20 "	Return Tubular	"
Two	54 "	Two-flue	"

One Boiler for Consolidation Locomotive.

Richmond Locomotive & Machine Works,
RICHMOND, VA.



ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.

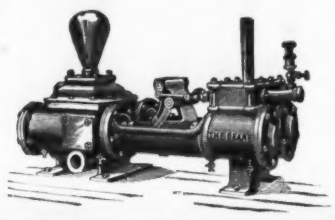
We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.

MANUFACTURERS

with an established business who are desirous of removing their works to a place within an hour of New York City; with good water front for sites; with water and rail transportation, and most attractive for residence, will find it to their advantage to address

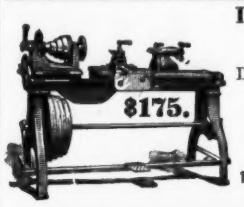
STAMFORD BOARD OF TRADE,
Stamford, Conn.



THE DEANE
OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

CRESCENT STEEL CO.
Pittsburgh, Pa.
Chicago, Ills.
New York, N. Y.

MAKERS OF
FINE STEEL
For Dies, Punches, Taps, Reamers, Cold Chisels, Lathe Tools, Shear Blades, Milling Cutters, Etc., Etc.



Improved Screw Cutting Foot and Power. LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
THE SEBASTIAN-MAY CO.,
167 to 175 Highland Avenue, SIDNEY, OHIO.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

TOBIN BRONZE
Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive
CAN BE FORGED HOT.
Round, square, and hexagon bars for pump, piston rods, bolts and screws. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Spring wire.
Send for Circular.
ANSONIA BRASS & COPPER CO.,
Sole Manufacturers
19 & 21 CLIFF ST., NEW YORK.

FINE TAPS, DIES, REAMERS, Etc.

LIGHTNING AND GREEN RIVER SCREW PLATES.
Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-Saving Tools Send for Price List.
WILEY & RUSSELL MFG. CO., GREENFIELD, MASS. New York Office, No. 126 Liberty St.

JESSOP'S STEEL
For TOOLS, DRILLS, DIES, &C.
All Kinds in Stock.
Gold Medal, Paris, 1889.
MANUFACTORY,
WILLIAM JESSOP & SONS, L'D. | SHEFFIELD, ENGLAND. | Chief American Office, 91 JOHN ST., NEW YORK.

15 Projected Railroads, 16,000 Miles River Navigation, Coal, Natural Gas, Coke, Oil, Clays, Glass Sand and Building Stone, Hard and Soft Wood Lumber, Iron from the South and Lakes at Lowest possible Cost are the resources at

KANAWHA CITY, W. VA.

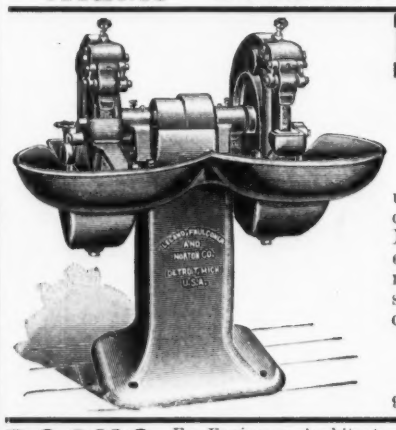
We want Manufacturers. This is a splendid point; one of the best in the U. S. for the **Manufacture of Machinery.** Cheap fuel. Cheap feights. Cheap raw materials. Cheaper than almost anywhere else. Free sites and liberal inducements, and incomparable advantages are offered. Write for prospectus and particulars. Address

B. D. AVIS, General Manager,
CHARLESTON, W. VA.

R. MUSHET'S SPECIAL and TITANIC STEELS.

How to get the best results with "R. MUSHET'S SPECIAL STEEL." Greatly increase your speeds and feeds; then compare the work you turn off with that done by any other known Steel. This will make the first cost of "Mushet's" look insignificant.

B. M. JONES & CO.,
Sole Representatives in the United States.
11 & 13 Oliver St., BOSTON, MASS.



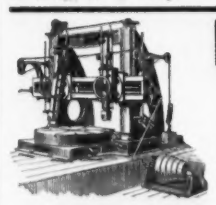
LELAND, FAULCONER & NORTON CO.
WET EMERY GRINDER.

Any amount of water easily applied without the use of Pump, Hose, Treadles, Cocks, or any of the objectionable features common in this class of Machine. Truing Device, which is inexpensive, does the work perfectly and quickly. The whole rig practically as simple as the old-fashioned grindstone trough and much more effective. Send for circular.

LELAND, FAULCONER & NORTON CO.,
96 to 106 Bates Street, DETROIT, MICH.

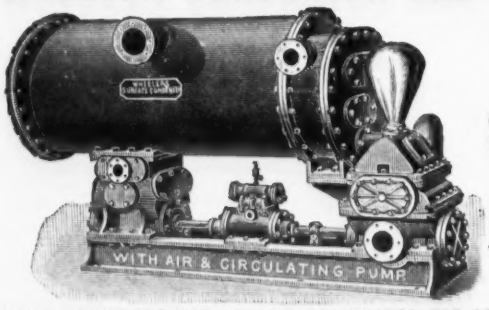
BOOKS For Engineers, Architects, Surveyors, Draftsmen, Railroad Construction, and for Scientific and Technical Schools. For sale by ENGINEERING NEWS PUB. CO., Tribune Building, N. Y. City.

INCOMBUSTIBLE MACHINERY
Wiping Material, much cheaper and better than Cotton Waste. Consumers and dealers should write for particulars to Borden & Remington, Fall River, Mass., U. S. A.



BORING AND TURNING MILLS
COMBINING EVERY IMPROVEMENT.
14 Sizes—From 5 to 20 feet.
BETTS MACHINE CO.,
WILMINGTON, DEL.

WHEELER CONDENSER AND ENGINEERING WORKS,
93 Liberty Street, NEW YORK.



Proprietors and Manufacturers of
WHEELER'S
Improved Patent Surface Condensers,
ALSO THE
Wheeler "Admiralty" Condenser,
With Patent Screw Glands.
The Wheeler-Lighthall Condenser,
With Patent Waterproof Packing.
LIGHT WEIGHT SURFACE AND JET CONDENSERS, FOR STEAM YACHTS, ETC. SEND FOR PAMPHLET.

NICHOLSON FILE COMPANY,
PROVIDENCE, R. I.

FILES AND RASPS
FOR EVERY VARIETY OF WORK.

THE BERLIN IRON BRIDGE CO.
Office and Works: East Berlin, Conn.

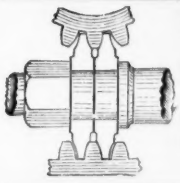
The illustration shown above is taken direct from a photograph showing the interior of an iron foundry designed and built by us for The Farrel Foundry & Machine Co., at Ansonia, Conn. The building is 120 ft. in width by 301 ft. in length. The central portion being 56 ft. wide, served by two hydraulic traveling cranes of 50 tons capacity. This is probably the best and most complete foundry for heavy castings to be found in the United States.

SEND FOR OUR ILLUSTRATED CATALOGUE.

AGENCIES:

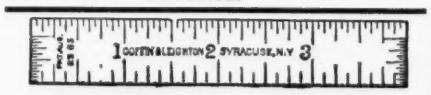
S. W. BOWLES, Jr., Western Mgr. 556 Rookery Bldg., Chicago, Ill.
M. B. GRANT, Enterprise, Miss.
WM. PAYSON, San Antonio, Tex.
W. E. STEARNS, 318 Odd Fel. Bldg., St. Louis, Mo.

NO MACHINE SHOP CAN AFFORD TO BE WITHOUT
NICHOLSON'S EXPANDING MANDRELS.
Write for latest Circular. W. H. NICHOLSON & CO., Wilkes-Barre, Pa.

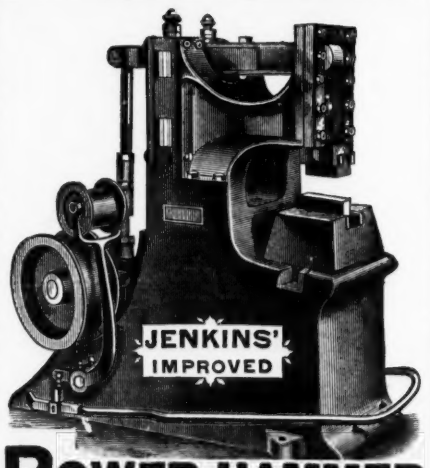


SOMETHING NEW
CLOUCH'S PATENT
DUPLEX GEAR CUTTER
One pair cuts both Circular and Diametral Pitches 1 in. C and 3 D, 3-4 C and 4 D, 1-2 C and 6 D, 3-8 C, 8 D and C. One pair cuts 2 Pitches. Send for Circular and prices to
R. M. CLOUGH.
MERIDEN, CONN.

WILLIAMS & LOUDAN
MECHANICAL ENGINEERS.
17 & 21 Fink's Buildings,
MELBOURNE, AUSTRALIA.
Manufacturers represented on Commission. Indents Executed.



MACHINISTS' SCALES,
PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEIGHTON, SYRACUSE, N. Y.



POWER HAMMER
The superiority of this Hammer is due to the excellence of design as regards **EFFICIENCY, SIMPLICITY and DURABILITY.**
JENKINS & LINGLE, Bellefonte, Pa.
PITTSBURGH OFFICE—517 Lewis Block.

BUFFALO FORGES.
BUFFALO FORGE CO., BUFFALO, N. Y.

WE WILL
REMOVE
Our business May 1st, 1891, to Nos. 163 and 165 Washington St.,
where we will have increased facilities for handling our growing business.
Preparatory to removal we offer at special low prices:
One 5 x 6 Greenfield Yacht Engine.
One 7½ x 9 Kreibel Vertical Engine.
One No. 5 Roots Forge, hearth 36" x 60".
One No. 1 Knowles Boiler Feed Pump.
One 4" x 2½" x 7" Hastings Boiler Feed Pump.
One 5" x 3" x 8" Hastings Boiler Feed Pump.
One Cast Iron Front for 66" tubular Boiler, and other Tools and Supplies.
COOKE & CO.,
Present address
No. 22 Cortlandt St., New York.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

THE DE LAMATER IRON WORKS,
(Incorporated 1889.)
Foot West 13th St., NEW YORK,
MANUFACTURERS OF
GENERAL MACHINERY,
Having acquired the Steam Pump business, formerly carried on by C. H. De Lamater & Co., offer both single and duplex Steam Pumps at very low prices.

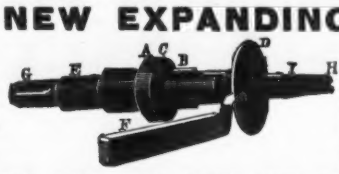
C. H. De Lamater & Co. offer for sale the following tools:
2 25 ton Traveling Cranes.
1 18 " " "
1 Horizontal Boring Mill, 62"x18'.
1 Heavy conbined Punch and Shear.
Large lot of Lathe and Planer Tools, Wood Pulleys, Propeller Wheels, and three 700 lb. Binary Ice Machines.

The FOX Patent Universal Trimmer.

Over 2800 in use.
ORIGINAL IMPROVED
Saves Time, Saves Money. Three Sizes, Four Styles, from New Patterns. *No Pattern Room Complete without Them.* See cut of Trimmer in our advt. in next week's issue. Send for Catalogue.
Beware of Imitations, we will prosecute all Infringements.
THE FOX MACHINE CO.,
325 N. Front Street, Grand Rapids, Mich.

MACHINE WORK
OF ANY DESCRIPTION TO ORDER OR BY CONTRACT.
Experimental Work a Specialty.
REPAIRING AND JOBBING.
Satisfaction Guaranteed.
W. S. WILLIAMSON,
36 to 40 Penn St., BROOKLYN, N. Y.

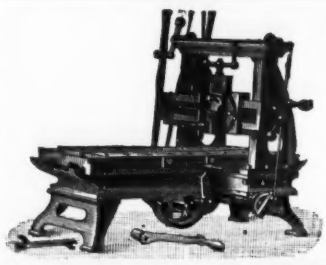
LECOUNT'S NEW EXPANDING MANDREL.
Amateur's Size.
Taking anything from ⅛ to 1 inch inclusive.
Price.....$5.00
Patented Dec. 25, 1877.



Machinist's Size.

No.		Price.
1	⅛ to 1 in.	$10
2	1 " 1½ "	14
3	1½ " 2 "	18
4 (with screws)	2 " 3 "	32
5 "	3 " 4 "	44

IF YOU WILL TRY THIS TOOL YOU WILL NOT REGRET THE EXPENSE.
C. W. LECOUNT, SOUTH NORWALK, CONN.
SPECIAL MANDRELS FOR SPECIAL JOBS MADE TO ORDER.



SMALL POWER OR HAND PLANER.
FOR ANY SMALL WORK.
Weight of Platen 100 lbs.
A. J. WILKINSON & CO.,
184 Washington St., BOSTON, MASS.
SEND FOR CIRCULAR.

BOOKS
—FOR—
ENGINEERS AND FIREMEN
THE BEST BECAUSE
they are written in plain, practical language, devoid of theories or mathematical formulæ.
These books embrace all branches of Steam Engineering—Stationary, Locomotive, Fire, and Marine. Any engineer who wishes to be well informed in all the duties of his calling should provide himself with a full set. They are the only books of the kind ever published in this country, and they are so plain that any engineer or fireman that can read can easily understand them.

Hand-Book of the Locomotive. Price....$2.50
Engineers' Handy-Book. Price.....$3.50
Instructions and Suggestions for Engineers and Firemen. Price.....$2.00
Use and Abuse of the Steam Boiler. Price.$2.00
Catechism of High Pressure Steam Engines. Price.....$2.00
Hand-Book of Modern Steam Fire Engines. Price.....$3.50
Hand-Book of Land and Marine Engines. Price.....$3.50
Questions and Answers for Engineers. Price.....$3.00
Care and Management of the Steam Boiler. Price.....$2.00
Young Engineer's Own Book. Price.....$3.00

FOR SALE BY ALL BOOKSELLERS.
Any of the above books will be sent to any part of the United States or Canada on receipt of list price.
Send money in Registered Letter, P. O. Order, or Postal Note.
Send for Descriptive Catalogue mailed free to any address.
EDWARD MEEKS, Publisher,
1012 Walnut Street, PHILADELPHIA, PA.

FITCHBURG Machine Works
Manufacturers of
METAL-WORKING MACHINES.
Office and Works,
13 to 21 Main Street,
FITCHBURG, MASS.
SEND FOR CATALOGUE (E.)

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
810 Walnut St., Philadelphia.
☞Our New and Revised Catalogue of Practical and Scientific Books, 87 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

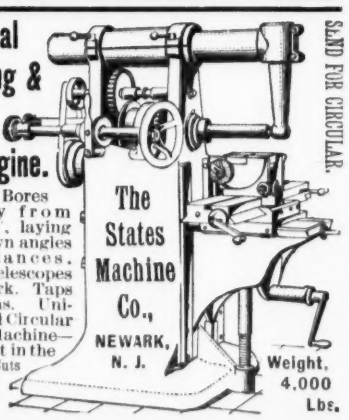
THE BRITISH & EUROPEAN PATENT AGENCY.
F. W. BARKER, Manager, (Registered English Patent Agent, According to Act of Parliament,)
252 Broadway, New York.
Monument Chambers, King William St., London, E. C., England.
American and European Patents obtained at equitable rates. *Special Facilities for Sale of Foreign Patents through our London House. A good invention is worth as much in Great Britain as in the U. S.* Competent draftsmen employed on premises. We refer to well known men in the machine trades for whom we have done business.
Epitome of the World's Patent Laws and Statistics Sent Free on Application

JUST PUBLISHED.
A MANUAL OF
MARINE ENGINEERING,
The Designing, Construction, and Working of Marine Machinery.
By A. E. SEATON, M. Inst., C. E.
NINTH EDITION.
Thoroughly revised and enlarged, with many additional illustrations.
8vo, Cloth, Price, $5.00.
D. VAN NOSTRAND CO.,
23 Murray & 27 Warren St., NEW YORK.
Sent by mail on receipt of price.

SEND SAMPLE.
We make a specialty of all kinds of screw machine work and do it cheaper than you can.
WRITE FOR CATALOGUE.
BLAUVELT, JOY & BLAUVELT,
Factory, Pearl & Front Sts., Brooklyn. Office, No. 258 Broadway, N. Y.

CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK.

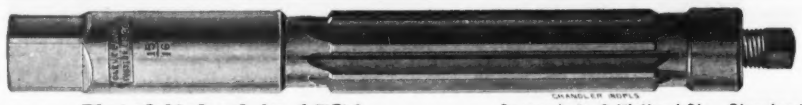
Universal Boring & Milling Engine.



SEND FOR CIRCULAR.
The States Machine Co.,
NEWARK, N. J.
Weight, 4,000 Lbs.
Drills and Bores accurately from ¼" to 10", laying out its own angles and distances. Spindle telescopes to the work. Taps and reams. Universal and Circular Milling Machine—the stiffest in the market. Cuts gears of all kind up to 30"

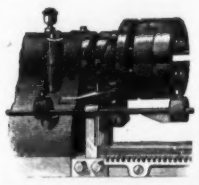
THE PECK PATENT DROP PRESS
MINER & PECK M'F'G CO.
SUCCESSORS TO BEECHER & PECK
NEW HAVEN, CONN.
DROP FORGINGS

WORTHINGTON—HIGH DUTY—Pumping Engine
—FOR—
WATER WORKS
OVER 100,000,000 DUTY
—GUARANTEED—
SEND FOR RECENTLY ISSUED PAMPHLET
HENRY R. WORTHINGTON
NEW YORK CITY

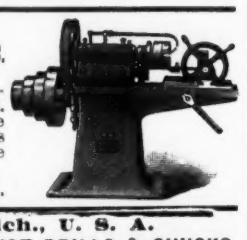


Established in 1874.
CLEVELAND TWIST DRILL CO.
Corner Lake & Kirtland Sts., Cleveland, O.
100 & 102 Reade Street, New York.
85 Queen Victoria St., London, Eng.

HOWE'S STEEL. FOR TAPS, DIES, PUNCHES, CHISELS, DRILLS, LATHE TOOLS, &c.
ESTABLISHED 1859.
HOWE, BROWN & CO., L'T'D., PITTSBURGH, PA.
93 JOHN ST., NEW YORK. 127 OLIVER ST., BOSTON. 228 LAKE ST., CHICAGO.



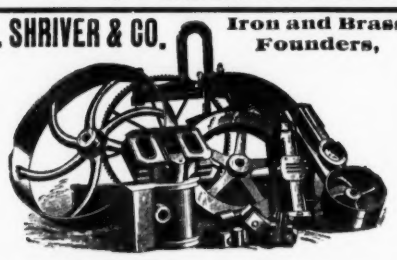
ADAMS
Automatic Bolt-Threading & Nut Tapping Machine.
Made in all Sizes to Cut from 1-4" to 6".
The simplest and most durable machine in existence. The threading head is made entirely of steel. No links, levers, springs, caps, cases, blocks or die rings in or about the head. Separate Heads and Dies Furnished. Write for descriptive circular and price list to
Capitol Mfg. Co., 125 to 137 Rees St., Chicago, Ill., U. S. A.



GRAHAM TWIST DRILL CO., Detroit, Mich., U. S. A.
Sole Manufacturers of GRAHAM'S PATENT GROOVED SHANK TWIST DRILLS & CHUCKS.

Endorsed by Practical Mechanics Everywhere. Send for Catalogue and Prices.

T. SHRIVER & CO. Iron and Brass Founders,



333 EAST 56TH ST., N. Y. CITY,
Make a Specialty of
NICE GREY IRON CASTINGS,
Soft, Smooth, and True to Patterns.
Contracts for Castings in Regular Supply Solicited

BELLOWS
Beam Micrometer

Send for Catalogue to
STANDARD TOOL CO., Athol, Mass.

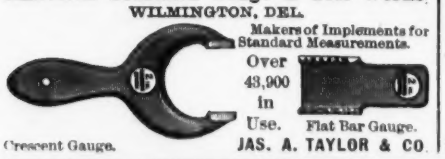
KEUFFEL & ESSER CO.
NEW YORK.
FACTORY, HOBOKEN, N. J.
Manufacturers of
Drawing Materials, Etc,
Superior Swiss Drawing Instruments, Extra and Best Quality, German Drawing Instruments, Paragon, Duplex, Universal, Anvil Drawing, Helios, Blue Process Papers, Scales, Triangles, T-Squares, Drawing Boards, Standard Profile, and Cross-section Papers.
Catalogue to professional people on application.

STEAM
PARK Double Jet INJECTOR

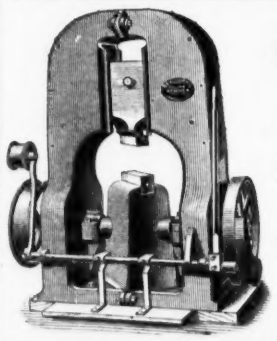
PARK MFG. CO.,
51 Portland Street, Boston, Mass.
TO THE BOILER
WATER
THE most reliable under varying steam pressure of any injector known. Will work from 15 pounds to 180 pounds without any adjustment. The only Automatic Injector that will thoroughly drain itself when shut off, thus preventing freezing. *Every Machine Guaranteed.*
INJECTORS AND JET APPARATUS.

PATENT UNIVERSAL DEPTH ANGLE AND SCREW-CUTTING CENTER
J. WYKE & CO., TWIST DRILL GAUGE.
Fine Machinists' Tools.—E. Boston, Mass.—Send for Circular.

American Standard Gauge & Tool Works
WILMINGTON, DEL.
Makers of Implements for Standard Measurements.

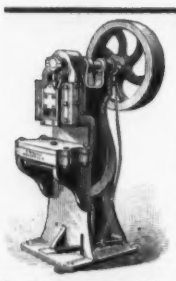


Over 43,900 in Use.
Flat Bar Gauge.
Crescent Gauge.
JAS. A. TAYLOR & CO.



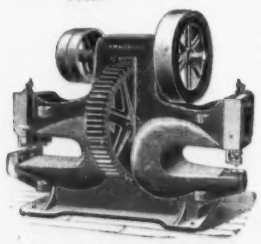
BEAUDRY'S NEW POWER HAMMER.
Send for Descriptive Circular
BEAUDRY & CO.,
Sole Manufacturers.
Also Manufacturers of
Hard Coal Heating Forges.
Room 4, Mason B'dg.
70 KILBY ST., BOSTON, MASS.

THE STILES & PARKER PRESS CO.,
Middletown, Conn.
MANUFACTURERS OF
Presses and Dies, Drop Hammers,
SHEET METAL TOOLS.
WRITE FOR PRICES.

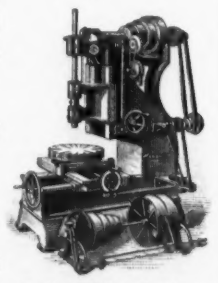


No. 94. - Power Punching Press.

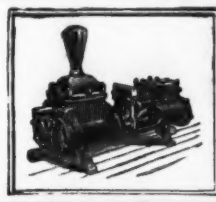
E. W. BLISS COMPANY, L'T'D.
BROOKLYN, N. Y.
Manufacturers of
TOOLS FOR WORKING SHEET METALS,
Drop Presses, Forging Presses, Drawing Presses, Lever Presses, Embossing Presses, &c., &c.
Dies of all kinds, Squaring, Trimming and Slitting Shears, for Rolling Mill and other Work, Tinners' and Canmakers' Tools.
Vertical and Two-Spindle Milling Machines, Horizontal Boring Mills
PUNCHES and SHEARS,
For Boiler Makers, Bridge and Ship Builders, Arch'l Iron Works, &c.



Punch and Shears Combined.



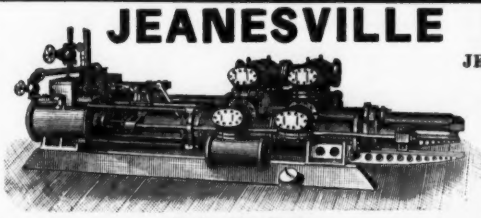
Vertical Milling Machine.



THE BUFFALO STEAM PUMP CO.
BUFFALO, N.Y. MANUFACTURERS OF
STEAM PUMPS
FOR ALL DUTIES.

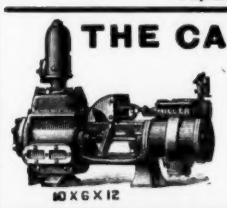
SNOW STEAM PUMP WORKS,
BUFFALO, N. Y.
STEAM PUMPS, POWER PUMPS, &c., FOR ALL SERVICES.

JEANESVILLE IRON WORKS,
JEANESVILLE, LUZERNE CO., PA.
BUILDERS OF
SPECIAL PUMPS OF ALL KINDS,
DUPLEX OR SINGLE,
SIMPLE OR COMPOUND.
Mine Pumps, Sinking Pumps, Pressure Pumps, Vacuum Pumps, Artesian Well Pumps, Power Pumps, Etc., Etc.



Duplex Mine Pump.

THE CANTON STEAM PUMP CO., CANTON, OHIO.
Manufacturers of
STEAM PUMPS for EVERY PURPOSE.
BOILER FEEDERS A SPECIALTY.
NEW DESIGNS AND IMPROVEMENTS.
Absolutely First Class.
Discounts and Terms on Application.



10 X 6 X 12

2¼ X 1⅞ X 2½

Maslin's Patent Steam Pump.
Cheapest and Best Automatic Steam Vacuum Pump. Handles DIRTY and GRITTY LIQUIDS without Oil or Care. Simplest, and most durable Pump made, as partial removal of two bolts makes every valve readily accessible. Pumping Plants for Contractors, Irrigation, Water Works, Railroads, Mining and General Hydraulic Purposes. Send for Circulars. John Maslin & Son, Sole Mfrs., 165-167 1st St., Jersey City, N. J.

COMPLETE STEAM PUMP
10 SIZES FROM $7 TO $75
WATER SUPPLY TANKS.
FIRE PUMPS & ETC.
WRITE FOR PRICES AND DESCRIPTIVE CIRCULARS
VAN DUZEN & TIFT
SOLE MAKERS
CINCINNATI, O.

ROSS ANTI-FRICTION BALL BEARING COLLAR.
A new Patent Application of Ball Bearing, patented Dec 2, 1890, to Drill Presses, Lathe and all end thrust of Horizontal Shafts in Machinery. 96 per cent. of the friction overcome by this device. Full satisfaction guaranteed.
JOSIAH ROSS, 1443 to 1459 Niagara Street, Buffalo, N. Y.

STEVENS PATENT
NEW EXACT SURFACE GAUGE

Superior to all others in quick, fine adjusting powers, especially in grasp of pointer. Also adapted to a depth gauge and various purposes.
Price, each small size, 8 inches.....$2.00
Price, " large " 12 " 2.75
Ideal and Leader Spring Dividers and Calipers, Depth Gauges, and Fine Machinists' Tools.
☞ *Illustrated catalogue free to all.*
J. STEVENS ARMS & TOOL CO.,
P. O. Box 231. Chicopee Falls, Mass.

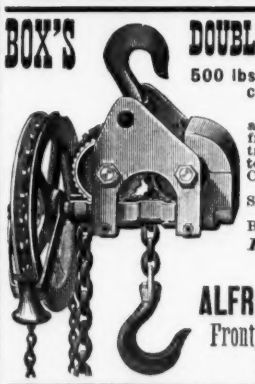
BOWSHER'S BALANCING WAY.
3 Sizes and Styles.
For bench and floor use.

Bench Style.
A new idea. A time saver. A tool to take the place of the devices in present use for balancing pulleys, armatures, cutter heads and rotary parts of machinery in general. Substantial. Accurate. Send for circular.
N. P. BOWSHER, SOUTH BEND, IND.
Manufacturer of Specialties in Wood and Metal.

UNIVERSAL RADIAL
RADIAL DRILLING MACHINES
THREE DESIGNS. SIX SIZES
EMBODY ALL DESIRABLE FEATURES
PRICES $450.00 & UPWARD
ADDRESS UNIVERSAL RADIAL DRILL CO
CINCINNATI, O. U.S.A.

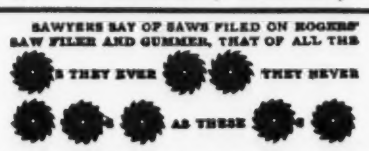
MACHINERY
For Reducing and Pointing Wire.
ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
For Machines or Information, address the Manufacturer,
S. W. GOODYEAR, Waterbury, Ct.

BOX'S DOUBLE SCREW HOIST,
500 lbs. to 20 Tons Capacity carried in Stock.



Full line of Cranes usually in course of erection, from the small single track and trolley, to 50-ton Traveling and Jib Cranes.
Radial Drills for Machine Shop use.
Special Radials for Bridge Builders.
Photos and Cuts on Application.
ALFRED BOX & CO.,
Front, Poplar & Canal Sts.,
Philadelphia, Pa.

SAWYERS SAY OF SAWS FILED ON ROGERS' SAW FILER AND GUMMER, THAT OF ALL THE

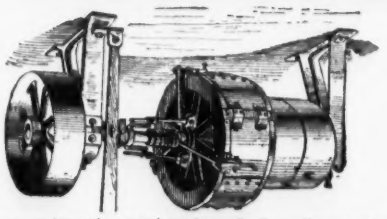


DO THEY EVER THEY NEVER AS THESE

Drop a postal card in the slot and get a Catalogue.
SAMUEL C. ROGERS & CO.,
BUFFALO, N. Y.

I. P. RICHARDS PROVIDENCE, R. I.
No 2 1/16
NEW STANDARD PUNCHES.
BEST SYSTEM on earth for PUNCHING IRON AND STEEL.

PERFECTLY UNIFORM SPEED!



The most irregular speed made perfectly uniform and regular. A change of over 30 per cent. can be obtained, while machine is in motion. Essential in all factories and mills and for driving dynamos. Makes power from water wheels, slow speed engines and electric motors absolutely regular and reliable.
Apply for information to
T. M. FOOTE REGULATOR CO.
Office: Exchange Building, Boston, Mass. Works at Ashland.
Western Agents: CHANDLER & LITTLEFIELD, Marine Bldg, Chicago, Ill.

P. H. & F. M. ROOTS,
Connersville, Indiana,
MANUFACTURERS OF
PORTABLE FORGES, TUYERE IRONS, ETC.

ROOTS' NEW ACME HAND BLOWERS
Slow speeded, Force-blast. Durable, Compact and Cheap.
Roots' Foundry Blowers, Gas Exhausters, etc.
S. S. TOWNSEND, Gen. Agt. } 22 CORTLANDT ST.,
COOKE & CO., Selling Agts. } NEW YORK.

In Writing, Please Mention This Paper.

WHEN IN WANT OF

A Boiler for AN-OUT-OF-THE-WAY OR HARD-TO-GET-AT **Location**

ADDRESS

HARRISON SAFETY BOILER WORKS,

Germantown Junction, Philadelphia, Pa.

NEW YORK, N. Y. 41 Dey Street. | CHICAGO, ILL. 6 So. Canal Street. | ATLANTA, GA. 9 No. Pryor Street. | MINNEAPOLIS, MINN. 421 Guaranty Bldg.

This System of Feed Water Heater is the Best

AND THE

LOWE

is the simplest

HEATER

on the System.

Has Straight Tubes

With reliable provision for expansion, and will

HEAT AND PURIFY THE WATER

EQUAL TO ANY

with same Feet of Heating Surface and

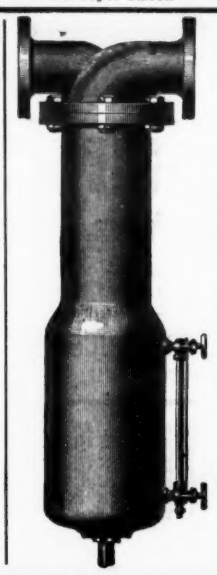
Wear the Longest.

Send for description and Histories of Boilers and Feed Water Heaters to

Bridgeport Boiler Works

Bridgeport, Conn.

POND ENGINEERING CO., AGENTS.
ST. LOUIS. CHICAGO. KANSAS CITY. OMAHA.



DRY STEAM

FURNISHED BY

THE POND SEPARATOR.

The Pond Separator is guaranteed to relieve the steam of all entrained water, and return this water to the Boiler, thus effecting a large saving in fuel.

Send for Circular.

Pond Engineering Co.,

St. Louis, Kansas City, Dallas, | Chicago, Omaha, Seattle.

Westcott Chuck Co., Formerly **Oneida Steam Engine & Foundry Co., Oneida, N.Y., U.S.A.**

Manufacturers of all kinds of

LATHE

—AND—

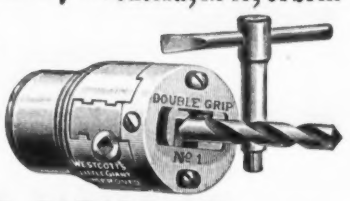
DRILL

CHUCKS.

Under Westcott's Patent.

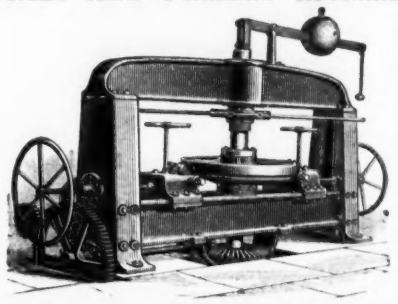
Capacity Little Giant Improved Double Grip.

No.	Diameter.	Holding Drills.
0	2¼ inch.	0 to 1/2 inch.
1	2¾ "	0 to 5/8 "
2	3½ "	0 to 1 "
2½	4 "	0 to 1 in., extra strong.
3	6 "	0 to 1½ inch.
4	6½ "	0 to 2 "



SEND FOR ILLUSTRATED CATALOGUE.

O'BRIEN'S PATENT BOILER HEAD FLANGING MACHINE.



Rapid Work. Perfect Heads, with or without Dies. No Hole in Plate. Construction Simple. Price Reasonable.

JACOB CLARK, Mfr., Germantown, Philadelphia, Pa.

"THE HORTON LATHE CHUCK"

has sustained the tests and been the STANDARD for FORTY YEARS.

Over THREE HUNDRED sizes and styles of Chucks, made and kept in stock, by

THE E. HORTON & SON CO.,

Windsor Locks, Conn., U. S. A.

Send for Illustrated Price List.

THOS. H. DALLETT & CO.,

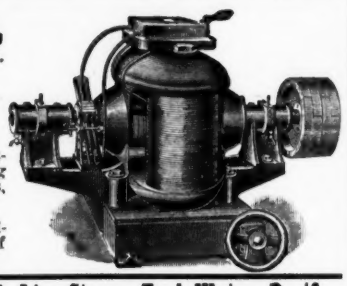
York St. & Sedgley Ave., Philadelphia.

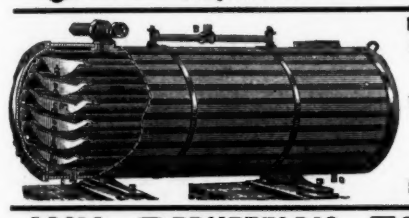
Manufacturers of

Portable Drills, Hand Drills, Boiler Shell Drills, Light Drill Presses.

ELECTRIC MOTORS, Specially adapted for driving Machine Tools, Cranes, Elevators, Pumps, Presses and other Machinery.

ELECTRIC GENERATORS, For installation of Complete Power Plants.





The HOPPES Live-Steam Feed-Water Purifier,

Guaranteed to Prevent Scale in Boilers.

Using any kind of water. Hard Sheet Steel Troughs. *Easily Cleaned.*

HOPPES MANUFACTURING CO.,

Send for Catalogue D. SPRINGFIELD, OHIO.

WM. BERKEFELD'S FOSSIL MEAL COMPOSITION.

The Only Genuine Fossil Meal.

The best non-conducting material known for Steam Pipes and Boilers. Can be easily removed and repeatedly reapplied.

ITS PLASTIC NATURE INSURES AN ABSOLUTELY TIGHT JOINT.

Requires less thickness than any other covering, and is therefore the CHEAPEST.

Trade-mark W. B. C.

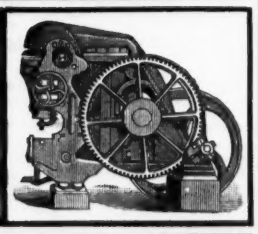
FOSSIL MEAL CO., 2 Cedar Street, N. Y.

A. GIESE, Proprietor.

PUNCHING AND SHEARING MACHINERY AND BOILER MAKER'S ROLLS

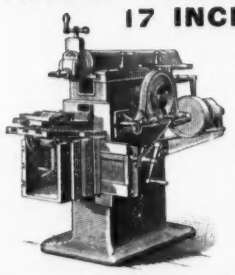
NEW DOTY MANUFACTURING CO.

JANESVILLE, WISCONSIN



PATENT FRICTION SHAPER.

17 INCH STROKE.



Double racks allowing shaft 2½ to pass through base. Adjustable table for taper work, swivel jaw vise, feed adjustable while running, driven by hardened steel worm in phosphor bronze wheel; smooth running, powerful, durable.

J. D. Wright & Sons,

69 & 71 GEORGE ST., BROOKLYN, E. D., N. Y.

W. C. YOUNG & CO., Worcester, Mass. Manufacturers of

Engine Lathes, Hand Lathes.

FOOT POWER LATHES, SLIDE RESTS, ETC.

GRAPHITE

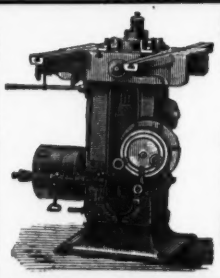
Plumbago

BLACK LEAD

Ground and prepared in quantities from ¼ lb. to a shipload. Lubricating Graphite a specialty. If you are at all interested in Graphite it will pay you to correspond with us, as different kinds are required for different purposes. All letters promptly answered.

Jos. Dixon Crucible Co.,

JERSEY CITY, N. J.



KEY SEATERS

PORTABLE AND STATIONARY.

RACK-CUTTING ATTACHMENT KEY-MAKING MACHINES.

Giant Key-Seater Co.,

EAST SAGINAW, MICH.

BEVEL GEARS,

Cut Theoretically Correct.

For particulars and estimates apply to

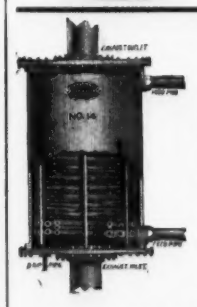
HUGO BILGRAM,

MACHINIST,

Successor to

BREHMER BROS.,

440 N. 12th St., Philadelphia, Pa.



THE NATIONAL Feed-Water HEATER.

A brass coil Heater delivering water to the boiler at 210° Fahrenheit.

400,000 Horse Power sold. Prices Low. Satisfaction universal.

THE NATIONAL PIPE BENDING CO.,

82 River Street, NEW HAVEN, CONN.

STEEL STAMPS.

Largest & Oldest House in America. Send for catalogue. Established 1849.

The HOGGSON & PETTIS Mfg Co.

NEW HAVEN, CONN.

SCROLL SAWS

THE

FLEETWOOD & DEXTER

ARE THE BEST.

THOUSANDS SOLD.

Write for Illustrated Price Lists to

TRUMP BROS. MACH. CO.

Manufacturers.

WILMINGTON, DEL., U. S. A.

THE "FOWLER" SPEED INDICATOR

Counts to 5000. Price, $2.00.

CHANDLER & FARQUHAR,

177 Washington St., Boston

Send for Catalogue.

INDEPENDENT CHUCKS.

(See AM. MACHINIST, Nov. 5, 1887.)

Before buying Chucks of this class, write us for particulars of our latest improvements. Different from other makes, and we claim several points of superiority which we submit to the judgment of mechanics.

THE D. E. WHITON MACHINE CO.,

NO. 5 OAK ST., NEW LONDON, CONN.

S. A. SMITH, 23 S. Canal St., Chicago, Western Agt.

ALUMINUM $1 PER POUND.

THE

Pittsburgh Reduction Company,

95 FIFTH AVENUE,

PITTSBURGH, PA., U. S. A.

Have reduced the price of commercially pure aluminum to

$1 Per Pound

for any quantity over one pound.

Prices on sheet, wire, and castings upon application.

Metal below 97% and over 90% pure, containing no sulphur or phosphorus, for alloying with iron or steel, 90 cents per pound.

PATENT OILERS, CYLINDER SIGHT FEED CUPS.

Government Regulation

POP SAFETY VALVES,

For Stationary, Marine and Locomotive Boilers.

J. E. LONERGAN & CO., BRASS FOUNDERS AND FINISHERS,

211 Race Street, Philadelphia, Pa.

1888 CATALOGUE FREE ON APPLICATION.

REMOVES SCALE!

Engineers agree that our **Boiler Cleansing Compound** cannot be equalled

(LORD'S PATENT,)

for Removing and Preventing Scale in Steam Boilers.

Saves Fuel, Labor and Time, and prevents Corrosion in all its forms, and is guaranteed free from anything injurious to iron by the Chemists for United States Mint.

Engineers will receive free, on application, a 25-ct. book "HINTS FOR STEAM USERS."

BRANCHES: Baltimore, Md., New York, Pittsburgh, Pa., Chicago, Ill. and London, England.

S. W. Lord & Co., 11 So. 9th St., Philadelphia, Pa.

PREVENTS CORROSION!

Wagon Wheel Hub Press.

HYDRAULIC MACHINERY

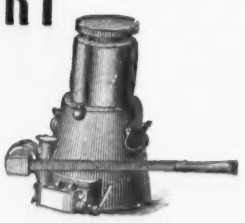
PRESSES, PUMPS, PUNCHES,

JACKS, VALVES, FITTINGS, PACKINGS,

ACCUMULATORS.

Watson & Stillman, Mfrs.

204, 206, 208 & 210 E 43d St., New York.

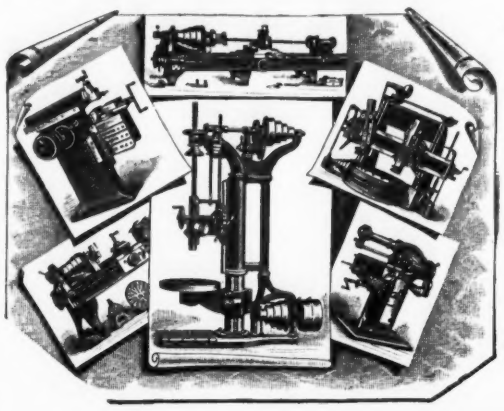


Outside Pump Jack.

HILL, CLARKE & CO.

156 Oliver Street, Boston, Mass.

Engine Lathes, Metal Planers, Upright Drills, Shapers, Milling Machines, Screw Machines, Gear Cutting Machines, Boring Mills, Chucking Lathes.



Pattern Makers' Lathes, Pattern Makers' Saw Tables, Jig Saws. Buzz Planers. Steam Hammers, Helve Hammers, Bolt Cutters, Bolt Headers, Nut Tappers.

Machinery and Machine Supplies,

FOR MACHINE, PATTERN AND BLACKSMITH SHOPS.

SEND FOR CATALOGUE.

WORCESTER MACHINE SCREW CO.

WORCESTER, MASS.

Manufacturers of Set, Cap & Machine Screws, Studs, etc.

EMPLOYERS' LIABILITY ASSURANCE Corporation Limited London-Eng.

Deposited in the U. S. $845,000.00.

Policies issued giving full protection to Employers against loss by Claims from Employes on account of Accident. Rates Proportioned to Risks of Occupation. One Premium the only Payment during year. No Contingent or other Liability on part of Employer.

CHIEF OFFICE IN THE UNITED STATES:

71 KILBY ST., BOSTON, MASS.

ENDICOTT & MACOMBER,

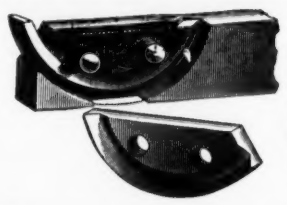
Managers and Attorneys.

BOSTON: Samuel Appleton, 28 Central St.
NEW YORK: Edmund Dwight, Jr., General Agent, 51 Cedar Street.
MIDDLE DEPARTMENT: Tattnall Paulding, Resident Adviser; John G. Hooven, Manager; John M. Ash, Jr., General Agent, 416 to 420 Walnut Street, Philadelphia.
CHICAGO: Geo. A. Gilbert, 226 and 228 La Salle St.
ST. LOUIS: F. D. Hirschberg Bro., 120 N. Third St.

AGENTS IN ALL THE PRINCIPAL CITIES.

Crescent Lathe AND Planer Tools.

NO FORGING.



UNIFORM TEMPER.

It will pay you many times over, to use these Tools and throw away your old forged ones. Send for Circular and Prices.

FRASSE & CO.,

92 Park Row, New York.

CATALOGUE TOOLS & SUPPLIES FREE

TAPS TO FIT MACHINE SCREWS ALL SIZES

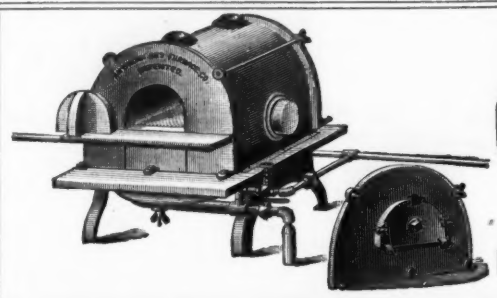
63 SUDBURY ST. BOSTON

GOODNOW & WIGHTMAN

SAW TABLES FOR PATTERN MAKERS.

ROYLE MACHINE WORKS,

PATERSON, N. J.



American Gas Furnace Co.,

Designers and Manufacturers

GAS BLAST FURNACES.

Send for Catalogue. Estimates made for any mechanical operation requiring **high, even** and **controllable temperature.**

No. 80 NASSAU STREET

NEW YORK.

A. R. KING MFG. CO.,

Steel Screw Punches, Tube Expanders, Packer Ratchet Drills, Tube Cutters, Tube Brushes, Etc.

SCREW PUNCH.

WRITE FOR PRICE LIST.

ROLLER EXPANDER.

ERIE, 11th & 12th STREETS, - - - JERSEY CITY, N. J.

FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS

JAS. HUNTER & SON,

North Adams, Mass.

CHALLENGE

UNIVERSAL GRINDING MACHINE.

Send for Catalogue.

Adapted for External and Internal Cylindrical Grinding, straight or taper, also for Grinding Tools, Reamers, Milling Cutters, etc. Made by

The Appleton Mfg. Co.

30th & Thompson Streets,

PHILADELPHIA, PA.

Grinding Machinery for all purposes. Over 100 different patterns.

Established 1845.

BUILD and REPAIR YOUR MACHINERY BY USING

MACHINE TOOLS

Manufactured by

LATHE & MORSE TOOL CO.,

Worcester, Mass., U. S. A.

SEND FOR CATALOGUE D.

CAUTION

Any Key Seat Cutter with a tool connected to a reciprocating head and made adjustable towards and from the work, and having a vise in which a Key may be fastened in proper position to be cut, infringes claim 8, 9, 16, 17 and 18 of our Morton Patent No. 375,680, of Nov. 22d, 1887.

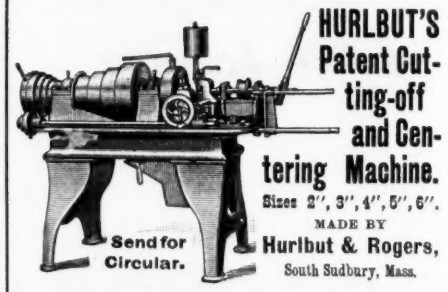
THE MORTON Lightning Key-Way Cutter and Key Maker,

Portable Key-Way Cutters and Portable Planers a specialty ranging in size and capacity from the smallest work to key-ways 5 ft. long and 6 ins. wide. Over 150 machines in use in the leading shops of this and other countries.

MORTON MFG. CO.,

Romeo, Mich.

"We have no machine in our works of same cost that earns as much money as yours." EDW. P. ALLIS & Co. Edwin Reynolds, Supt



HURLBUT'S Patent Cutting-off and Centering Machine.

Sizes 2", 3", 4", 5", 6".

Send for Circular.

MADE BY

Hurlbut & Rogers,

South Sudbury, Mass.

PATENTS for inventions procured. Litigation, Searches, Opinions, &c. Trade Marks, Labels, &c., registered.

J. NOTA McGILL, Attorney-at-Law,

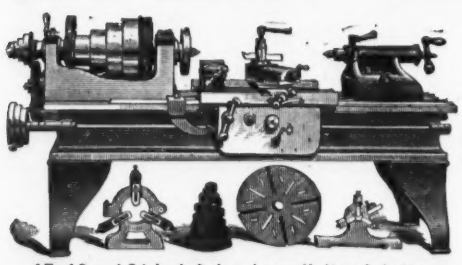
ATLANTIC BUILDING, WASHINGTON, D. C.

THE LODGE AND DAVIS MACHINE TOOL CO.

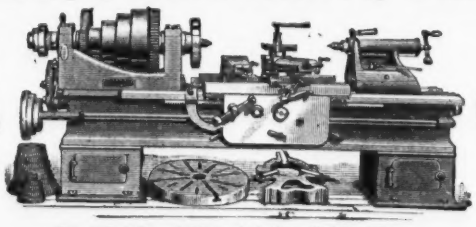
Works, CINCINNATI, OHIO.

EASTERN HOUSE:
64 Cortlandt St.,
NEW YORK.

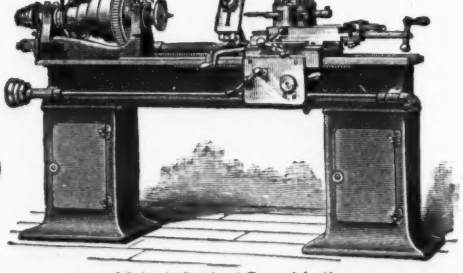
WESTERN HOUSE:
68 & 70 S. Canal St.,
CHICAGO.



17, 19 and 21-inch Swing, Large Hollow Spindle.
Taper Attachment, Automatic Stop, Compound Rest, Lead Screw, under front V. All feeds reversed in apron.
Extra heavy, Convenient, and easily handled.

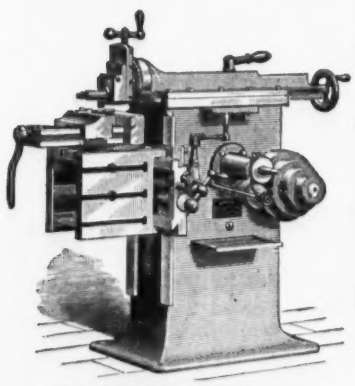


24, 27, 32 and 38-inch Swing, Cabinet Legs.



18-inch Cabinet Turret Lathe.
Taper Attachment, Automatic Feed, Lever and Screw Movement, most complete brass lathe on the market.

COMPLETE MACHINE SHOP EQUIPMENTS A SPECIALTY.



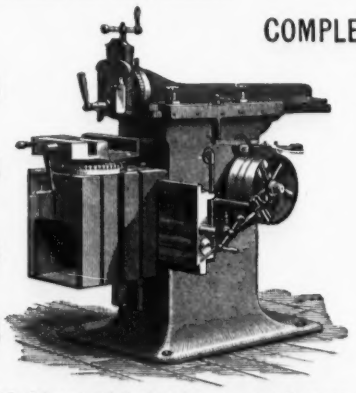
15 and 20-inch Crank Shaper.
Stroke changed and adjusted while running. Stroke at all times positive.
Invariably plane to a line.
Detachable Tables.

ENGINE LATHES

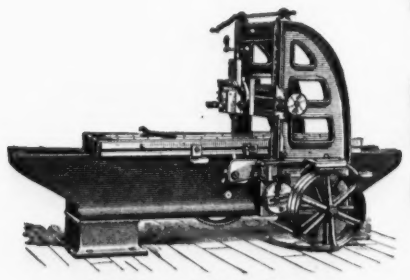
TURRET LATHES

IRON PLANERS

PULLEY LATHES



20, 26 and 32-inch Triple Geared Shapers.
Stroke changed while machine is running. Shaft can be passed through head of machine and key seat cut in same to any length. Extra heavy vises. Tables slotted on all sides.

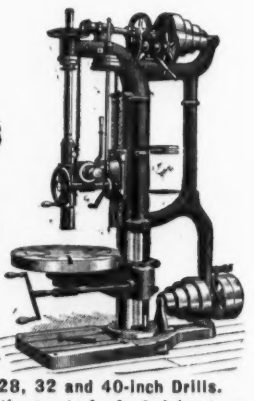


24, 32 and 36-inch Planers.
Extra deep beds and tables. Powerfully geared. Plenty of Metal and designed for extra heavy duty. All Feeds and Shipper operated from both sides.
Improved device for holding Planer Bolts.

DRILL PRESSES

MILLING MACHINES

IRON SHAPERS



25, 28, 32 and 40-inch Drills.
Automatic stop to feed. Quick return on right side. Table operated from front. Large cones and long belts.

PITTSBURGH HOUSE,
Cor. Market and Water Sts., PITTSBURGH, PA.

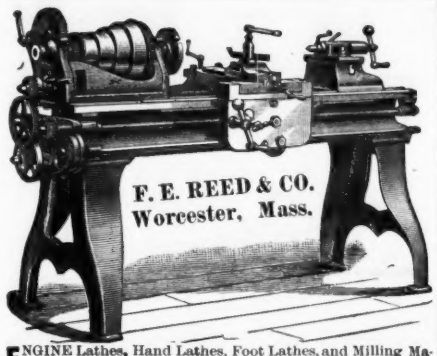
SOLE AGENT FOR GREAT BRITAIN,
ALFRED HERBERT, COVENTRY, ENGLAND.

See Advertisement on Page 20.

MORSE TWIST DRILL AND MACHINE COMPANY, New Bedford, Mass.

Manufacturers of Morse Patent Straight-Lip Increase Twist Drills.

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.



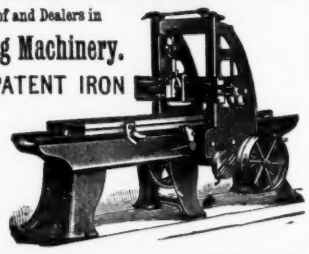
ENGINE Lathes, Hand Lathes, Foot Lathes, and Milling Machines. Agents, MANNING, MAXWELL & MOORE, 111 LIBERTY STREET, NEW YORK.

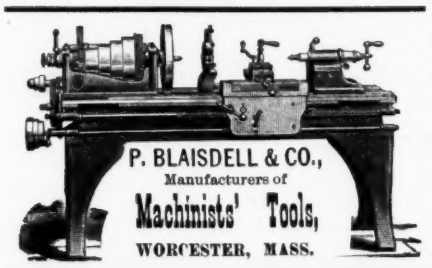
FLATHER ENGINE LATHES.

14, 15, 16, 18, 20, 24 and 28 INCH SWING.
ANY LENGTH OF BED DESIRED.
HILL, CLARKE & CO.,
General Selling Agents,
156 OLIVER ST., BOSTON, MASS.

L. W. POND MACHINE CO.

Manufacturers of and Dealers in
Iron Working Machinery.
IMPROVED PATENT IRON PLANERS A SPECIALTY.
152 Union St., WORCESTER, MASS.





WILLIAM BARKER & CO.,

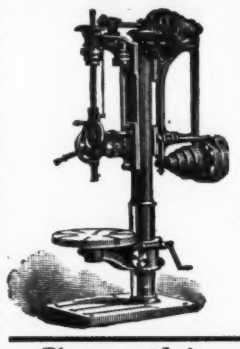
Manufacturers of
Iron and Brass Working
MACHINERY,
140 & 142 E. SIXTH ST.,
Near Culvert,
CINCINNATI, O.
Send for Circulars and Prices.

GAGE MACHINE WORKS,

MANUFACTURERS OF
MACHINE TOOLS,
WATERFORD N. Y.

NEW HAVEN MANUF'G CO.,

New Haven, Conn.



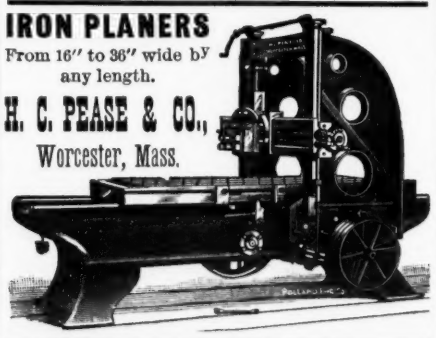
Lathes, Planers, Shapers, Slotters, Etc.

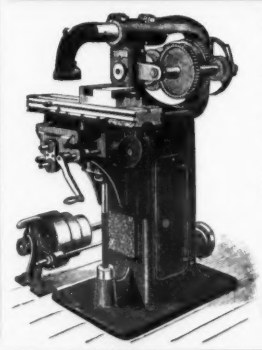
Something New!!
2 BY 24
TURN TABLE TURRET LATHE
Now Ready.
JONES & LAMSON MACHINE CO.
SPRINGFIELD, VERMONT.

PRENTICE BROS.,
Manufacturers of
Lathes & Upright Drills.
Lathes from 10 in. to 20 in. swing. Largest Variety of Drills manufactured in the world.
Worcester, Mass.

IRON PLANERS

From 16" to 36" wide by any length.
H. C. PEASE & CO.,
Worcester, Mass.





Complete Universal Milling Machines.
Plain Back Geared Milling Machines.
Plain Universal Heads.

All designed to meet the requirements of the best practice.

KEMPSMITH Machine Tool Co.,
MILWAUKEE, WIS.

D. SAUNDERS' SONS,

21 ATHERTON ST., Yonkers, N. Y.
MANUFACTURERS OF
Steam & Gas Fitters' Hand Tools.
SEND FOR CIRCULAR.

Pipe Cutting, THREADING, AND Tapping Machines.

THE PATENT WHEEL PIPE CUTTER shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel hardened. Less friction of parts than any other pipe cutter made.

HEADQUARTERS
—FOR—
MACHINE TOOLS

NEW ILLUSTRATED CATALOGUE NOW READY.
SHOWING LATEST IMPROVEMENTS IN MILLING AND SCREW MACHINES AND MONITORS.
FULL LINE OF
SECOND-HAND TOOLS
ALWAYS ON HAND.
THE GARVIN MACHINE CO.
LAIGHT AND CANAL STS., NEW YORK.

WORK SHOPS

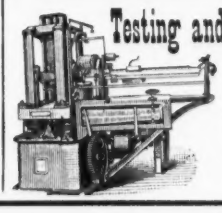
Of Wood and Metal Workers without Steam Power, Equipped with Outfits of
BARNES' PATENT
Foot Power Machin'y
allow lower bids on jobs, and greater profits than by any other means for doing work. Sold subject to trial in your shop. Send for Price-List Catalogue.
W. F. & JNO. BARNES CO.,
Address 1999 Ruby St., ROCKFORD, ILL.

Barnes' Foot-Power Machinery
Complete outfits for Actual Workshop Business. A customer says: "Considering its capacity and the accuracy of your No. 4 Lathe, I do not see how it can be produced at such low cost. The velocipede foot-power is simply elegant. I can turn steadily for a whole day, and at night feel as little tired as if I had been walking around." Descriptive Price List Free.
W. F. & JOHN BARNES CO.,
1999 RUBY ST., ROCKFORD, ILL.

CURTIS & CURTIS,

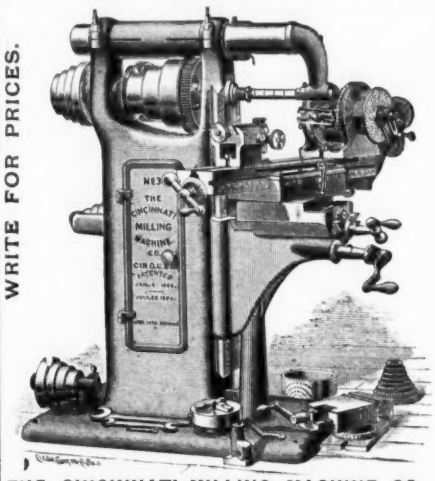
66 Garden St., Bridgeport, Conn.,
PIPE CUTTING AND THREADING MACHINERY
FOR HAND OR POWER.
Send for Illustrated Catalogue.

SWEET'S Measuring Machine.
The only micrometer that will not lose its accuracy by wear.
Satisfaction Guaranteed.
SYRACUSE TWIST DRILL CO.,
Syracuse, N. Y.



Testing and Hydraulic Machinery.
Novelty Patent Hand Drills.
TINIUS OLSEN & CO.,
MFRS.,
12th & Buttonwood Sts.,
PHILADELPHIA, PA.

NEW PATTERN!



WRITE FOR PRICES.

THE CINCINNATI MILLING MACHINE CO.,
SECOND & PLUM STS. CINCINNATI, O.

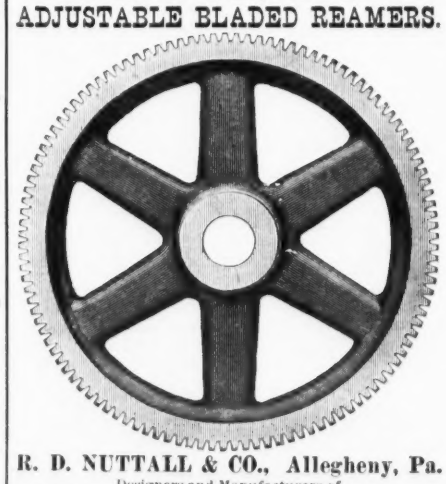
IMMEDIATE DELIVERY.
15" and 18" Crank
20" and 26" Geared
SHAPERS.
JNO. STEPTOE & CO., Cincinnati, Ohio.

BOYNTON & PLUMMER,

WORCESTER, MASS.
Manufacturers of
Shaping Machines, Drilling Machines, Bolt Cutting Machines.
Send for Catalogue.

SPECIAL MILLING CUTTERS, REAMERS,

DIES, TAPS, GEARS TO ORDER.
GEAR CUTTING TO ORDER up to 60 in. Diameter.
ADJUSTABLE BLADED REAMERS.



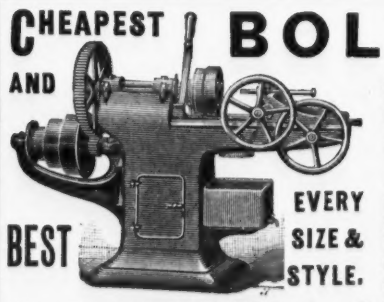
R. D. NUTTALL & CO., Allegheny, Pa.
Designers and Manufacturers of
SPECIAL MACHINERY AND TOOLS.

W. D. FORBES & CO., ENGINEERS. Are open to Contract for MACHINERY, MACHINE TOOLS, SPECIAL TOOLS, OR PATENTED ARTICLES, JOB WORK. NEW SHOP. NEW TOOLS. PERFECT EQUIPMENT, NO Makeshifts. Estimates given. DESIGNS FOR SPECIAL MACHINES. TAKE 14th Street Ferry TO 1300 Hudson St., HOBOKEN, N. J.

W. D. FORBES & CO. HOBOKEN, N. J.

Do You Use Glue?
Improved Steam Glue Heaters
without joints, and therefore free from leakage. Furnished with plain iron, Enameled Iron or Copper Pots. For Pattern Makers, Cabinet Makers, Joiners, Bookbinders, in fact, all who use Glue. Please mention this paper and send for Price List to makers. Made in nineteen different styles.
PANCOAST & MAULE,
245 South Third Street,
PHILADA, PA.
BUILD THESE

CHEAPEST AND BEST BOLT CUTTERS.



EVERY SIZE & STYLE.
H. B. BROWN & CO.,
EAST HAMPTON, CT.

H. BICKFORD,
LAKE VILLAGE, N. H.
BORING AND TURNING MILLS, 4, 5 and 6 Ft SWING.

SECRETARIES
—OF—
ENGINEERS' SOCIETIES

ARE ASKED TO SEND US THEIR ADDRESSES AND NUMBER OF MEMBERS IN THEIR RESPECTIVE LODGE AND WE WILL SEND THEM ENOUGH OF OUR LITTLE STAMP HOLDERS TO GIVE ONE TO EACH MEMBER OF THE LODGE.

MASON REGULATOR CO.,
BOSTON, MASS.

WILLIAM SELLERS & CO., Incorporated.

PHILADELPHIA, PA.

BUILDERS OF

MACHINE TOOLS FOR WORKING IRON AND STEEL

Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.

High Speed Power Traveling Cranes and Hand or Power Swing Cranes, Shafting, Pulleys, Hangers, &c., for transmission of power. Improved Self-Adjusting Injector of 1876. Self-Acting Injector of 1887. Fixed-Nozzle Automatic Injector of 1885.

INJECTORS for ALL CONDITIONS of LOCOMOTIVE and STATIONARY SERVICE.

THE LONG & ALLSTATTER CO., HAMILTON, OHIO.

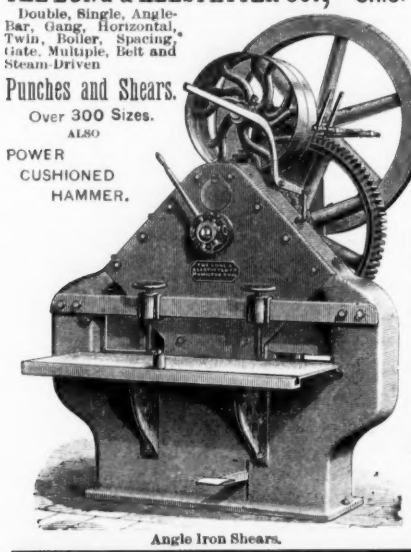
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven

Punches and Shears.

Over 300 Sizes.

ALSO

POWER CUSHIONED HAMMER.



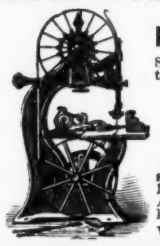
Angle Iron Shears.

SEND FOR NEW CATALOGUE.

J. A. FAY & CO. CINCINNATI, OHIO, U.S.A.

BUILDERS OF IMPROVED

WOOD-WORKING MACHINERY



Embraces nearly 400 Machines for

PLANING & MATCHING

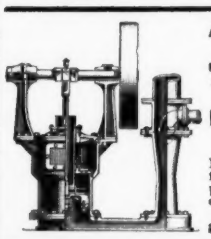
Surfacing, Moulding, Tenoning, Mortising, Boring, and Shaping, etc.

Variety and Universal

WOOD WORKERS.

Band, Scroll and Circular Saws, Resawing Machines, Spoke and Wheel Machinery, Shafting, Pulleys, etc. All of the highest standard of excellence.

W. H. DOANE, Pres. D. L. LYON, Sec'y.



Belt Power Air Pump and Condenser.

The CONOVER MFG. CO.,

CONSULTING AND MECHANICAL ENGINEERS

95 LIBERTY STREET, NEW YORK.

No Air Locks. 15 to 50 per cent. fuel saved or equal amount of power gained. Runs with same economy as engine. Adapted to all kinds of Engines. *Send for Circular.*

THE OPEN SIDE IRON PLANERS.

GUARANTEED

Equal to any Planer of the ordinary style in the performance of standard size work and in

EFFICIENCY, CAPACITY, AND ADAPTABILITY TO EXCEL

ANY OTHER METAL PLANING TOOL

Sizes 30″ to 120″ by any length. Write for prices and detailed information.

DETRICK & HARVEY MACHINE CO., Manufacturers, BALTIMORE, MD.

All GENUINE INGOTS & MANUFACTURES BEAR OUR REG. TRADE MARKS.

PHOSPHOR-BRONZE

INGOTS, CASTINGS & MANUFACTURES.

THE PHOSPHOR BRONZE SMELTING CO. LIMITED

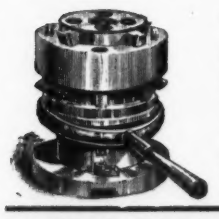
512 ARCH ST. PHILADELPHIA PA. U.S.A.

ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND OWNERS OF THE U.S. PATENTS.

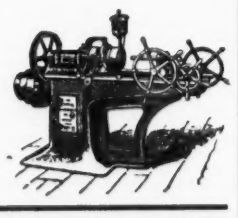
THE NATIONAL MACHINERY CO.

TIFFIN, OHIO.

Manufacturers of



12 Sizes of National Bolt Cutters.
6 Sizes and Styles of Rapid Bolt Cutters.
5 Sizes and Styles of Bolt Pointers.
15 Sizes and Styles of Bolt Headers.
12 Sizes and Styles of Nut Machines.
14 Sizes and Styles of Tappers.
3 Sizes and Styles of Washer Machines.
3 Sizes and Styles of Spike Machines.
2 Sizes of Car Link Machines.
3 Sizes of Car Pin Machines.
7 Sizes and Styles of Wire Nail Machines.
5 Sizes and Styles of Benders.
Complete outfits for Bolt shops.



CATALOGUE SENT ON APPLICATION.

RITTENHOUSE PATENT ADJUSTABLE GUIDE AND SPACING TABLE.

FOR THE USE OF BOILER MAKERS

Or other Structural Iron Workers.

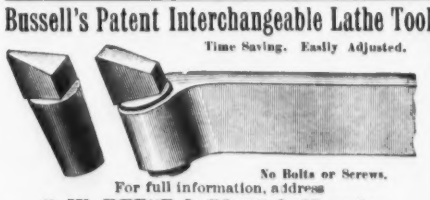
Designed for either straight or curved work.

Prices and descriptive circular sent upon application.

C. RITTENHOUSE & SONS, NORRISTOWN, PA.

Bussell's Patent Interchangeable Lathe Tool

Time Saving. Easily Adjusted.



No Bolts or Screws.

For full information, address

S. W. REESE & CO., Sole Manufrs.,

182 FULTON STREET, NEW YORK.

STUBS PATTERN RIFFLERS NEEDLE FILES GROBET PATTERN STUBS THE WORLD'S BEST

FILES

McFADDEN CO.,

735 MARKET ST. PHILADELPHIA.

THE INDISPENSABLE LATHE DOG.

DROP FORGED FROM BAR STEEL.

One Set of 3 does the work of 12 common dogs.

No. 1, ¼″ to 1¼″; No. 2, ½″ to 2¼″; No. 3, 1″ to 3¼″.

$7.50 Per Set.

These DOGS can be attached after the work is centered in the Lathe.

PALMER, CUNNINGHAM & CO., L'd.

607 Market St., PHILADELPHIA, PA.

BEMENT, MILES & CO.,

PHILADELPHIA, PA.

—BUILDERS OF—

METAL-WORKING MACHINE TOOLS

FOR

Railroad Shops, Locomotive and Car Builders, Machine Shops, Rolling Mills, Steam Forges, Ship Yards, Boiler Shops, Bridge Works, Etc., Etc.

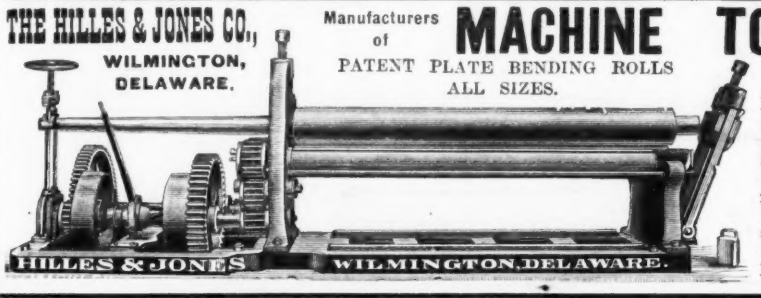
THE HILLES & JONES CO., WILMINGTON, DELAWARE.

Manufacturers of

MACHINE TOOLS.

FOR

PATENT PLATE BENDING ROLLS ALL SIZES.



Boiler Makers, Bridge Builders, Ship Builders, Railroad Shops, Locomotive and Car Builders, Etc., Etc.

WYMAN & GORDON,

WORCESTER, MASS.

DROP FORGINGS.

ACME MACHINERY CO.

CLEVELAND, OHIO.

Manufacturers of

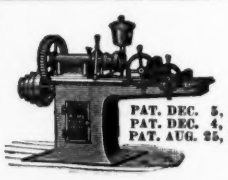
ACME BOLT & RIVET HEADERS,

Acme Single & Double Automatic BOLT CUTTERS.

Cutting from 1-8 in. to 6 in. diameter.

Also SEPARATE HEADS and DIES.

FIRST PREMIUM, CINCINNATI CENTENNIAL.



PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.

SOUTH BROOKLYN STEAM ENGINE WORKS,

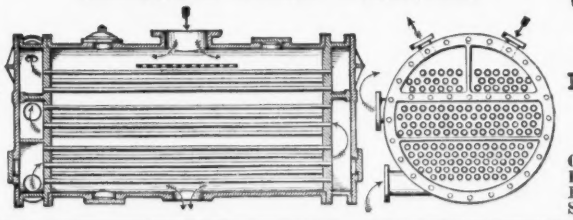
Successors to WILLIAM A. LICHTHALL.

VAN BRUNT AND SUMMIT STS., BROOKLYN, N. Y.

New York Office, 69 Wall St.

BUILDERS OF THE

Pat. Combined Surface Condenser and Feed Water Heater.



Lighthall Surface Condensers with Cobb's Improvements. Light Weight Brass Condensers a Specialty. Also Feed Water Heaters, Tube Heads, Screw Glands, Packings, &c.

ESTABLISHED 1842

ROBERT POOLE & SON CO.

ENGINEERS AND MACHINISTS.

MACHINE MOULDED GEARING.

ALL KINDS OF TRANSMISSION MACHINERY OF THE HEAVIEST CLASS.

BALTIMORE, MD.

FOR

Substantial, Well Made, Low Priced, Patented,

20 Inch Drills,

With latest improvements, Lever, Combination or Wheel Feed, address

Sibley & Ware,

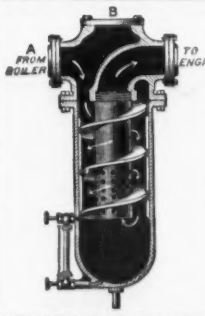
SOUTH BEND - INDIANA

Send 2-cent stamp for fully illustrated list.

L. S. STARRETT,

ATHOL, MASS.

Manufacturer of Fine Tools.



Simpson's Centrifugal Separator and Trap.

For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.

Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require; also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.

KEYSTONE ENGINE AND MACHINE WORKS

Fifth and Buttonwood Streets, Philadelphia,

Or, A. T. ARTHUR, Selling Agent, 13 Cortlandt St., N. Y.

THE STRATTON SEPARATOR

DELIVERS

DRY STEAM

To your engine or for any other purpose, no matter HOW LONG YOUR STEAM PIPE, or how much your BOILER MAY PRIME. An absolute safeguard. A source of economy.

—THE—

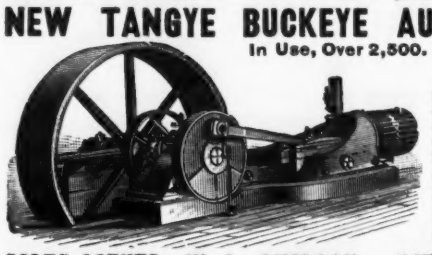
Stratton Separator Co.,

32 Cortlandt St., NEW YORK.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES

In Use, Over 2,500.

25 to 1,000 H. P.



These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H. P. for Driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail.

Address, BUCKEYE ENGINE CO., Salem, Ohio.

SALES AGENTS: W. L. SIMPSON, 10 TELEPHONE BUILDING. | N. W. ROBINSON, 154 Washington St., Chicago, Ill. | 18 CORTLANDT STREET, N. Y. | ROBINSON & CARY COMPANY, St. Paul, Minn.

KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland, and Virginia

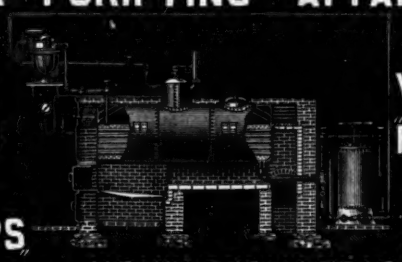
THE ALBANY STEAM TRAP Co

BOILER PURIFYING APPARATUS.

ALSO MANUFACTURERS OF

RENEWABLE SEAT VALVES

RETURN STEAM TRAPS



DUPLEX WATER FILTERS

PUMP GOVERNORS

AND

STEAM PUMPS

SEND FOR CIRCULARS. ALBANY STEAM TRAP CO. ALBANY, N.Y.

"OTTO" GAS ENGINE WORKS.

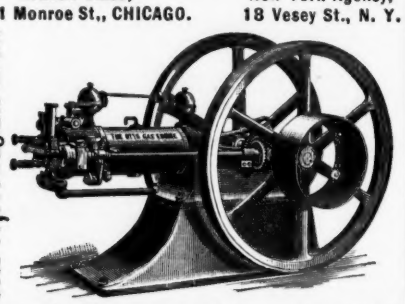
SCHLEICHER, SCHUMM & CO.,

33d and Walnut Sts., PHILADELPHIA.

Branch Office, 151 Monroe St., CHICAGO.

New York Agency, 18 Vesey St., N. Y.

Over 35,000 Engines in Use



Guaranteed to consume 25 to 75 per cent. less Gas than any other Gas Engine doing the same work.

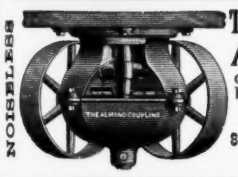
GASOLINE and GAS ENGINES

Our new Engines are hustlers. A 6 x 7 inch Engine, now running 100 feet of shafting. Boring Mills, Planers, Lathes, Drill Presses and Milling Machines for 20 Machinists, on 6 gal. Gasoline per day, costing only 60 cts. Write for information. *Mention this paper.*

Van Duzen Gas & Gasoline Engine Co.

CINCINNATI, OHIO.

NOISELESS



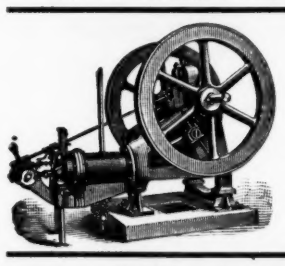
The Almond Coupling

A NEW quarter turn motion to replace quarter turn belts and bevel gears.

T. R. ALMOND, MFR.,

83 and 85 Washington Street,

BROOKLYN, N. Y.



ATKINSON CYCLE GAS ENGINE.

Four strokes of piston in one revolution of crank-shaft, expanding the charge to more than the original volume, driving out *all* the products of combustion, and giving a working stroke at every revolution and in half the time required by any other engine. *Send for Illustrated Circular.*

HENRY WARDEN, MANUFACTURER,

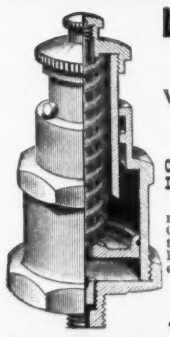
1810 ALLEGHENY AVENUE, PHILADELPHIA, PA.

BLAKE DAMPER REGULATOR.

Absolute perfection in graduated regulation. Guaranteed as represented or no sale. The diaphragm abolished. Pulls 250 pounds on dampers. The latest, best and cheapest. Nickel-plated. Correspondence invited.

JOHN HENRY BLAKE,

114 Liberty Street, NEW YORK.



LACKAWANNA GREASE CUP

Will Save its Cost in Oil alone Several Times per Annum.

SAVES ALSO IN LABOR AND COST OF COTTON-WASTE, PREVENTS DRIPPING AND SPATTERING.

A POSITIVE FORCE FEED with the most PERFECT REGULATION and GREATEST CONVENIENCE in operation yet attained in any device for the lubrication of machinery. Works equally well in every possible position.

Lackawanna Lubricating Co.,

41 Coal Exchange, Scranton, Pa.

OUR NEW CATALOGUE OF TOOLS

And Supplies sent free to any address on receipt of Ten Cents in Stamps (for postage).

Chas. A. Strelinger & Co., WOOD AVE. Detroit, Mich.

Machine Tools

IN STOCK.

FITCHBURG MACHINE WORKS,
Engine Lathes, "New Patterns."
14x6 ft., 16x6-8 ft., 18x8 ft., 24x12 ft.
Planer, 24x6 ft., Shaper, 14 in., Drills, 30-36 in.

PRENTICE BROS.,
Lathes, 12x6 ft., 15x6 ft., 17x6-8 ft., 18x8 ft.
Drills, 20-21-25 32 in. swing.

POWELL PLANER CO'S,
Planers, 24x6 ft., 30x8-10 ft., 36x10-12-14 ft.

HENDEY MACHINE CO'S,
Lathes, 14x6, 16x6 ft., Plain and Taper.
Planers, 16 in.; Shapers, 15-24 in.

KEMPSMITH MILLING MACHINE CO.,
Universal and Standard Milling Machines.

PERKINS MACHINE WORKS,
Lathes, 16x8 ft., 19x10 ft., 22x10 ft., 24x12 ft.

SECOND-HAND.

Putnam Lathe, 36x18 ft., modern, complete, A1 order	
Niles Screw Machine, 1¾ in. hole with tools,	good
Lincoln Milling Machine,	good as new
Profiling Machine, 2 spindle,	good order
Bement Axle Lathe,	good order
Hor. Boring Mill, 62 in.,	good order

Send for Complete List.

J. J. McCABE,

SUCCESSOR TO E. P. BULLARD'S N. Y. Mach'y Warerooms.

68 Cortlandt Street, NEW YORK.

MACHINE TOOLS

BORING AND TURNING MILLS,
LATHES,
TURRET MACHINES.

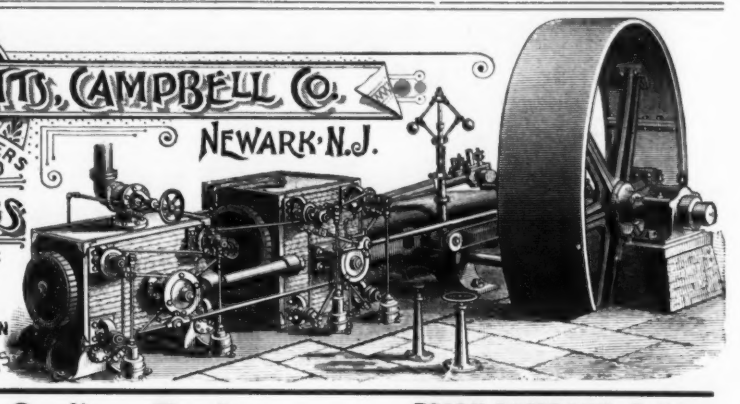
BRIDGEPORT MACHINE TOOL WORKS,
E. P. BULLARD, PROP'R.
BRIDGEPORT, CONN.

THE WATTS, CAMPBELL CO.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

CONTRACTS TAKEN FOR COMPLETE POWER PLANTS.

NEWARK, N.J.



Eclipse Corliss Engine.

FRICK COMPANY, Builders.

WAYNESBORO, PA.

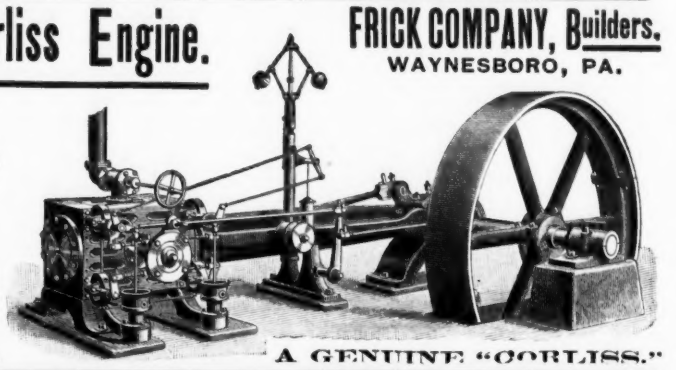
NON-CONDENSING, CONDENSING COMPOUND.

40 TO 1,000 H.P.

Send for Circulars.

ICE-MAKING AND REFRIGERATING MACHINERY.

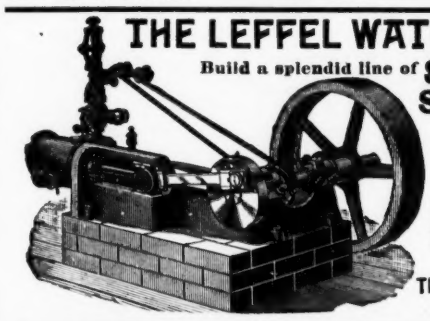
Send for Special Circular.



A GENUINE "CORLISS."

THE LEFFEL WATER WHEEL & ENGINE CO.

Build a splendid line of SELF-CONTAINED SIDE-CRANK ENGINES AND RETURN-FLUE BOILERS



8, 12, 16, and 20 Horse Power.

High in Grade. Low in Price. Strictly first-class. In design and construction SUPERIOR to all others. Write for ENGINE PAMPHLET.

Address us in full as follows:

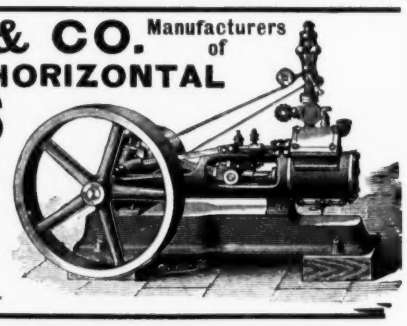
THE LEFFEL WATER WHEEL & ENGINE CO.

SPRINGFIELD, OHIO, U. S. A.

THE JAMES LEFFEL & CO.

Manufacturers of

IMPROVED UPRIGHT and HORIZONTAL ENGINES & BOILERS



3 TO 26 HORSE POWER.

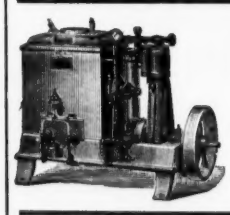
STRONGLY BUILT on BEST PRINCIPLES for SMOOTH and ECONOMICAL WORK.

Over 4000 in Use.

Write for FREE PAMPHLET and your wants to

THE JAMES LEFFEL & CO.

SPRINGFIELD, OHIO, OR NEW YORK CITY.



AUTOMATIC IN FUEL AND WATER SUPPLY.

THE SHIPMAN AUTOMATIC STEAM ENGINE.

PETROLEUM, KEROSENE OR NATURAL GAS FUEL,

1, 2, 4, 6 and 8 horse-power.

STATIONARY and MARINE. NO SKILLED ENGINEER.

SHIPMAN ENGINE CO.,

Send for Catalogue. 242 Summer St., Boston, Mass.

CHANDLER & TAYLOR CO'S SELF-CONTAINED STEAM ENGINES

Are tested under full load before shipment.

12 to 80 H.P. in Stock

ALSO SUITABLE BOILERS on hand for immediate delivery.

For Circulars address

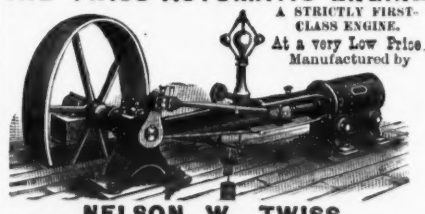
CHANDLER & TAYLOR CO. INDIANAPOLIS, IND.

THE TWISS AUTOMATIC ENGINE

A STRICTLY FIRST-CLASS ENGINE.

At a very Low Price.

Manufactured by



NELSON W. TWISS,

25 Whitney Ave., New Haven, Conn.

Send for Price before Purchasing Elsewhere.

ALSO VERTICAL AND YACHT ENGINES.

Heavy Slide-Valve Engines

and Saw-Mill machinery, of the highest class, all sizes.

THE LANE & BODLEY CO.,

CINCINNATI, O.

METAL PLANERS and SHAPERS

A SPECIALTY.

Send for Descriptive Circulars and Price Lists to

SMITH & SILK,

8th & Lock Streets, Cincinnati, O.

OFFICE, 15 CORTLANDT ST., N. Y. WORKS, ELIZABETH, N. J.

THE BALL & WOOD COMPANY,

BUILDERS OF

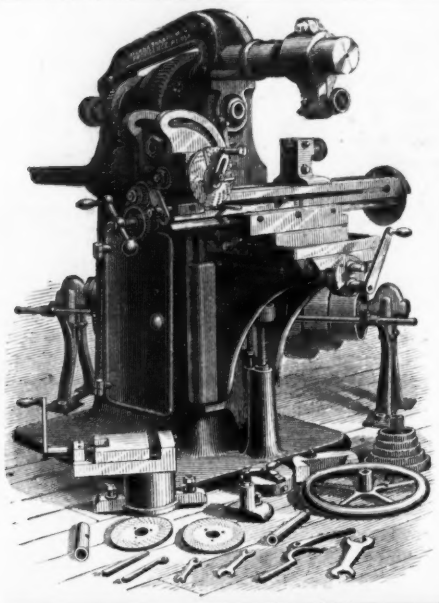
Ball Automatic Cut-Off Engines.

SIMPLE, COMPOUND, VERTICAL AND HORIZONTAL.

This Company has purchased of MR. FRANK H. BALL, formerly of Erie, Pa., his engine governing and other devices, and is engaged in building and equipping new and modern shops near New York; it will be prepared on June 1st to take orders for Ball Engines, built under Mr. Ball's personal supervision and with his latest improvements.

After May 6th, the business, firm name and good will of CHAS. R. VINCENT & CO., who for the past three years have had the agency of Ball Engines in the East, will be acquired by THE BALL & WOOD COMPANY. Mr. Vincent will become its Secretary, and Mr. Smith have charge of its interests at Cincinnati.

FRANK H. BALL, V. Prest. and Gen'l Manager. THOMAS C. WOOD, President.



BROWN & SHARPE MFG. CO.,

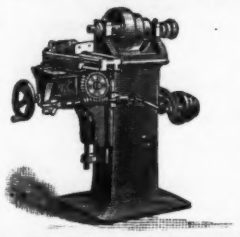
PROVIDENCE, R. I., U. S. A.

MILLING MACHINES.
GRINDING MACHINES.
MILLING & GEAR CUTTERS.
ENGINE LATHES. HAND LATHES.
CHUCKING MACHINES.
STANDARD GEARS. STANDARD GAUGES.
GEAR CUTTING MACHINES.
SCREW MACHINES.

CATALOGUE MAILED ON APPLICATION.

S. A. SMITH,
Western Representative,
23 So. Canal St., CHICAGO, ILLS.

THE PRATT & WHITNEY CO.
Hartford, Conn.

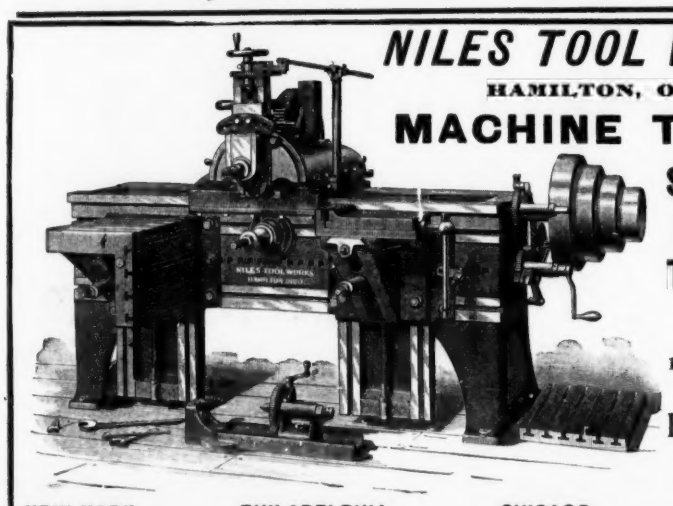


Manufacture Plain Milling Machines, with hand and power feed, of several sizes. Index, double face, vertical face, double spindle and shuttle race Milling Machines. Cam Cutters and Profiling Machines of several kinds. Milling Machines, Vises and Centers. Milling Cutter and Twist Drill Grinding Machines.

RACK AND GEAR CUTTING MACHINES.
KNURLING TOOLS. CUTTERS FOR THE TEETH OF SPUR WHEELS.

WESTERN BRANCH, 100 WEST WASHINGTON ST., CHICAGO, ILLS.

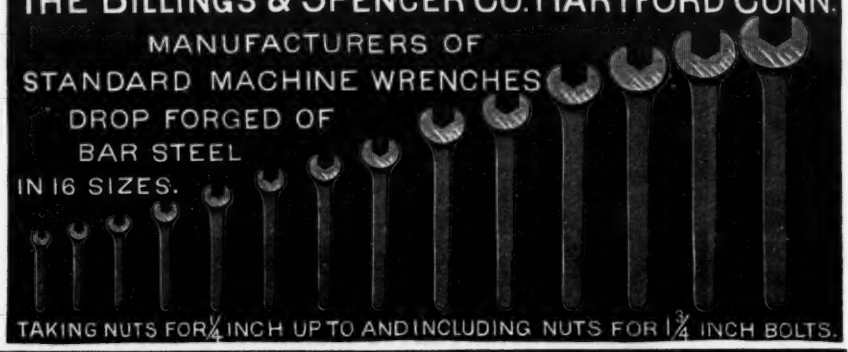
NILES TOOL WORKS,
HAMILTON, OHIO.



MACHINE TOOLS.
SHAPING MACHINES.
TRAVELING HEAD.
16, 18 and 24 inch Stroke.
Extra heavy and powerful.

NEW YORK, 98 Liberty St. PHILADELPHIA, 705 Arch St. CHICAGO, Phenix Building. PITTSBURCH, Lewis Block.

THE BILLINGS & SPENCER CO. HARTFORD CONN.
MANUFACTURERS OF
STANDARD MACHINE WRENCHES
DROP FORGED OF
BAR STEEL
IN 16 SIZES.

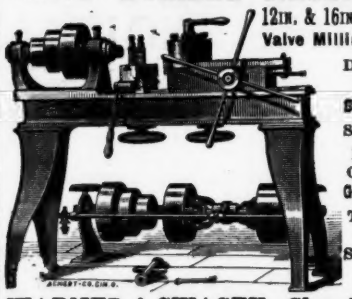


TAKING NUTS FOR ¼ INCH UP TO AND INCLUDING NUTS FOR 1¾ INCH BOLTS.

GRANES THE YALE & TOWNE MFG CO.
STAMFORD CONN
NEW YORK CHICAGO PHILA BOSTON

JENKINS STANDARD PACKING will pack a joint, no matter how rough or uneven the surface is.
The action of steam and heat on **JENKINS STANDARD PACKING** softens it, and by following up the joints, fills all cracks, &c. The continued heat on **JENKINS STANDARD PACKING** vulcanizes it, and it becomes hard as, and will last as long as metal itself, for the **JENKINS STANDARD PACKING**
does not ROT or BURN OUT. *JENKINS BROS., New York, Philadelphia, Boston & Chicago.*

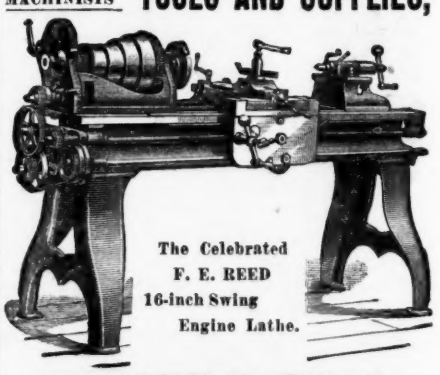
BRASS WORKING MACHINERY.



12in. & 16in. Monitors
Valve Milling Mach's
Double Key Lathes,
SpeedLathes,
Slide Rests,
Revolving Chucks for Globe Valves
Two-Jawed Chucks,
Small Tools and Fixtures.

WARNER & SWASEY, Cleveland, O.

MANNING, MAXWELL & MOORE,
Manufacturers and Dealers in all kinds of
RAILWAY and MACHINISTS' **TOOLS AND SUPPLIES,**



The Celebrated F. E. REED 16-inch Swing Engine Lathe.

111-113 LIBERTY ST., NEW YORK.
We carry the largest line of Tools and Supplies in the City.

GEO. W. FIFIELD,
MANUFACTURER OF
ENGINE LATHES
FROM 16 to 48 IN. SWING.
Cuts, Photographs and Prices furnished on application.
Lowell, Mass., U. S. A.

Key-Seating Machines and 20 in. Drills
A SPECIALTY.
SEND FOR LIST OF
New and Second-Hand
Lathes, Planers, Drills, or anything in Machinists' Tools or Supplies.
W. P. DAVIS,
Rochester, N. Y.
Works at North Bloomfield.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.

J. M. ALLEN, President.
Wm. B. Franklin, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary & Treasurer.

GEAR WHEELS, ready made.
WHEELS, made to order.
CUTTING, light or heavy.
CATALOGUE, gratis.
WORKS, Lexington, Mass

NEW PITTSBURGH MACHINERY STORE.

The increased demand for our Improved Machine Tools in the Iron District of Pennsylvania has decided us to open in the city of PITTSBURGH, a store for the Exhibition and Sale of our Labor-Saving Machine Tools.

THE LODGE & DAVIS MACHINE TOOL CO.,
COR. WATER & MARKET STREETS,
A. MULLER, Sec., Manager. PITTSBURGH, PA.

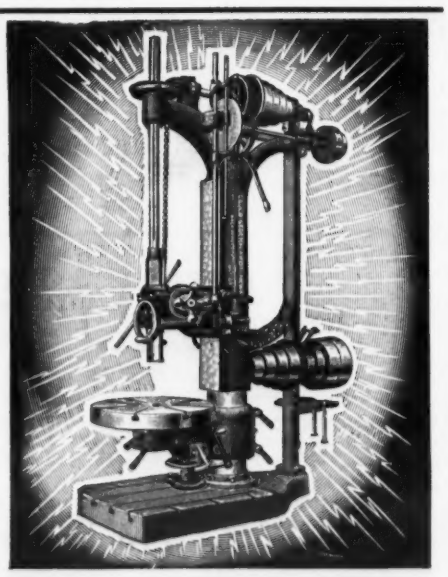
See Advertisement on page 16.

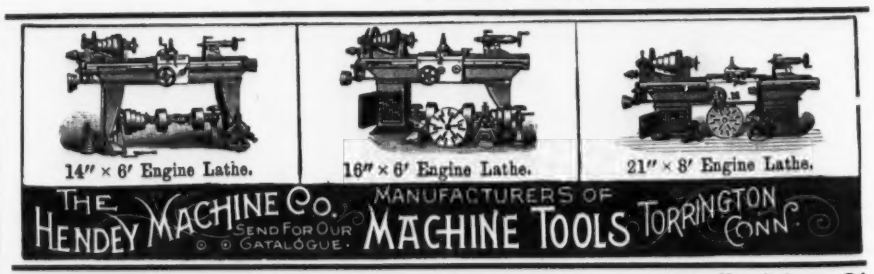
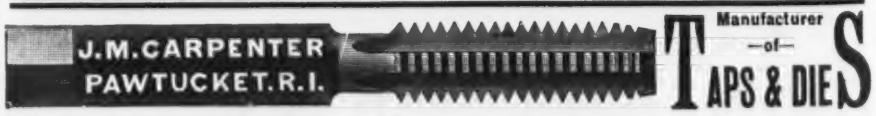
SECOND-HAND MACHINE TOOLS.

Planer, 15 in.x12 in.x3 ft., New Haven Mfg. Co.
" 24 in.x24 in.x5 ft., Gray.
" 30 in.x24 in.x5 ft., Lowell Machine Works.
" 33 in.x29 in.x9 ft., New Haven Mfg. Co.
" 33¾ in.x25 in.x6 ft. 7 in., Lyon & Bell.
" 36 in.x29½ in.x12 ft., Niles.
" 36 in.x24 in.x12 ft., Cone Machine Works.
Planer, 49 in.x49 in.x16½ ft., L. W. Pond.
Upright Drill Press, 28 in., Steptoe.
Radial Drill, 3½ ft. arm, E. & A. Betts.
" " 5 ft. " Dunbar.
Horizontal Cylinder Boring Machine, 14 ft. bed, Lyon & Bell.
Lathe, 16 in.x6 ft., Perkins.

ADDRESS **The G. A. GRAY CO., Cincinnati, Ohio.**

OTHERS can copy, but they
Cannot Excel.
THE
EBERHARDT'S PAT. DRILL PRESS,
22", 25", 32", 37", 43", 52",
Used by the U. S. Government
AND
ALL THE LEADING FIRMS.
WRITE TO
GOULD & EBERHARDT,
NEWARK, N. J.




14" × 6' Engine Lathe.
16" × 6' Engine Lathe.
21" × 8' Engine Lathe.
THE HENDEY MACHINE CO. SEND FOR OUR CATALOGUE.
MANUFACTURERS OF MACHINE TOOLS TORRINGTON CONN.